

PATENT ABSTRACTS OF JAPAN

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 KAWADA KEN

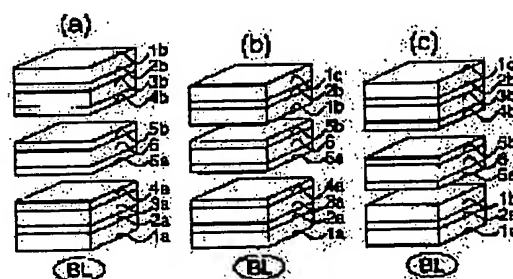
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(54) OPTICAL COMPENSATION SHEET, ELLIPTICAL PLATE, AND LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To make accurately optically compensable by imparting optical uniaxial or optical biaxial property to a transparent supporting body and aligning discotic liquid crystal molecules in a state having a specified average tilt angle between the disc faces of the discotic liquid crystal molecules and the transparent supporting body.

SOLUTION: A transmission type liquid crystal display device as an example consists of, in order from the back light BL side, a transparent protective film 1a, a polarizing film 2a, a transparent supporting body 3a, an optical anisotropic layer 4a, the lower substrate 5a of a liquid crystal cell, rodlike liquid crystal molecules 6, the upper substrate 5b of the liquid crystal cell, an optical anisotropic layer 4b, a transparent supporting body 3b, a polarizing film 2b, and a transparent protective film 1b. The transparent supporting body and optical anisotropic layer (3a to 4a, 4b to 3b) form an optical compensation sheet. In this case, the transparent supporting bodies 3a, 3b used have optical uniaxial or optical biaxial property. The discotic liquid crystal molecules are aligned at $<5^\circ$ average tilt angle between the disc faces of the discotic liquid crystal molecules and the faces of the transparent supporting bodies 3a, 3b.



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CLAIMS

[Claim(s)]

[Claim 1] The optical compensation sheet with which it is the optical compensation sheet which has the optical anisotropy layer formed from the transparence base material and the discotheque liquid crystallinity molecule, a transparence base material has optical optically uniaxial or optical optically biaxial, and the average tilt angle between the disk side of a discotheque liquid crystallinity molecule and a transparence base material side is characterized by the discotheque liquid crystallinity molecule carrying out orientation in the less than 5-degree condition.

[Claim 2] The optical compensation sheet according to claim 1 with which a transparence base material has the retardation within a field (Re) defined as 10 thru/or the range of 1000nm by the following formula.

$Re = (n_x - n_y) \times d$ [nx and ny are the refractive indexes within a field of a transparence base material among a formula, and d is the thickness of a transparence base material].

[Claim 3] The optical compensation sheet according to claim 1 with which a transparence base material has the retardation (Rth) of the thickness direction defined as 10 thru/or the range of 1000nm by the following formula.

$Rth = [(n_x + n_y) / 2 - n_z] \times d$ [nx and ny are the refractive indexes within a field of a transparence base material among a formula, and nz is the refractive index of the thickness direction of **, and d is the thickness of a transparence base material].

[Claim 4] The optical compensation sheet according to claim 1 with which an optical compensation sheet has the retardation within a field (Re) defined as 20 thru/or the range of 200nm by the following formula.

$Re = (n_x - n_y) \times d$ [nx and ny are the refractive indexes within a field of an optical compensation sheet among a formula, and d is the thickness of an optical compensation sheet].

[Claim 5] The optical compensation sheet according to claim 1 with which an optical compensation sheet has the retardation (Rth) of the thickness direction defined as 70 thru/or the range of 500nm by the following formula.

$Rth = [(n_x + n_y) / 2 - n_z] \times d$ [nx and ny are the refractive indexes within a field of an optical compensation sheet among a formula, and nz is the refractive index of the thickness direction of an optical compensation sheet, and d is the thickness of an optical compensation sheet].

[Claim 6] The elliptically-polarized-light plate with which it is the elliptically-polarized-light plate which has the optical anisotropy layer, polarization film, and transparence protective coat which were formed from the transparence base material and the discotheque liquid crystallinity molecule, a transparence base material has optical optically uniaxial or optical optically biaxial, and the average tilt angle between the disk side of a discotheque liquid crystallinity molecule and a transparence base material side is characterized by the discotheque liquid crystallinity molecule carrying out orientation in the less than 5-degree condition.

[Claim 7] It is the liquid crystal display which consists of a polarizing element of two sheets arranged at the liquid crystal cell in VA mode, and its both sides. The optical anisotropy layer in which at least one side of a polarizing element was formed from the transparence base material and the discotheque liquid crystallinity molecule, Are the elliptically-polarized-light plate which has the polarization film and a transparence protective coat, and a transparence base material

has optical optically uniaxial or optical optically biaxial. And the liquid crystal display with which the average tilt angle between the disk side of a discotheque liquid crystallinity molecule and a transprence base material side is characterized by the discotheque liquid crystallinity molecule carrying out orientation in the less than 5-degree condition.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the optical compensation sheet which has the optical anisotropy layer formed from the liquid crystallinity molecule, and the elliptically-polarized-light plate and liquid crystal display using it.

[0002]

[Description of the Prior Art] A liquid crystal display consists of a liquid crystal cell, a polarizing element, and an optical compensation sheet (phase contrast plate). In a transparency mold liquid crystal display, the polarizing element of two sheets is attached in the both sides of a liquid crystal cell, and the optical compensation sheet of one sheet or two sheets is arranged between a liquid crystal cell and a polarizing element. In a reflective mold liquid crystal display, it arranges in order of a reflecting plate, a liquid crystal cell, the optical compensation sheet of one sheet, and the polarizing element of one sheet. A liquid crystal cell consists of an electrode layer for applying an electrical potential difference to two substrates and cylindrical liquid crystallinity molecule for enclosing a cylindrical liquid crystallinity molecule and it. A liquid crystal cell is the difference in the orientation condition of a cylindrical liquid crystallinity molecule. About a transparency mold TN (Twisted Nematic), IPS (In-Plane Switching), FLC (Ferroelectric Liquid Crystal), OCB (Optically Compensatory Bend), STN (Supper Twisted Nematic), VA (Vertically Aligned), About ECB (Electrically Controlled Birefringence) and the reflective mold, various display modes like TN, HAN (Hybrid Aligned Nematic), and GH (Guest-Host) are proposed.

[0003] The optical compensation sheet is used with various liquid crystal displays, in order to cancel image coloring or to expand an angle of visibility. As an optical compensation sheet, the extension birefringence polymer film was used from the former. Replacing with the optical compensation sheet which consists of an extension birefringence film, and using the optical compensation sheet which has the optical anisotropy layer formed from the discotheque liquid crystallinity molecule on the transparence base material is proposed. Since there were various orientation gestalten in a discotheque liquid crystallinity molecule, the conventional extension birefringence polymer film enabled it to realize optical property which cannot be obtained by using a discotheque liquid crystallinity molecule.

[0004] The optical property of an optical compensation sheet is determined as the optical property of a liquid crystal cell, and a concrete target according to the difference among the above display modes. If a discotheque liquid crystallinity molecule is used, the optical compensation sheet which has various optical property corresponding to a display mode with various liquid crystal cells can be manufactured. With the optical compensation sheet using a discotheque liquid crystallinity molecule, the thing corresponding to various display modes is already proposed. For example, the optical compensation sheet for liquid crystal cells in TN mode has a publication in each specification of JP,6-214116,A, a U.S. Pat. No. 5583679 number, said 5646703 numbers, and the German patent official report 3911620A No. 1. Moreover, the optical compensation sheet for liquid crystal cells in IPS mode or FLC mode has a publication in JP,10-54982,A. Furthermore, the optical compensation sheet for liquid crystal cells in OCB mode or HAN mode has a publication in each specification of a U.S. Pat. No. 5805253 number

and international patent application WO 96/No. 37804. The optical compensation sheet for liquid crystal cells in STN mode has a publication in JP,9-26572,A further again. And the optical compensation sheet for liquid crystal cells in VA mode has a publication in the patent number No. 2866372 official report.

[0005]

[Problem(s) to be Solved by the Invention] It became possible to compensate a liquid crystal cell with replacing with the conventional extension birefringence polymer film, and using a discotheque liquid crystallinity molecule optically more correctly than before. For example, if the average tilt angle between the disk side of a discotheque liquid crystallinity molecule and a transparence base material side carries out orientation of the discotheque liquid crystallinity molecule in the less than 5-degree condition to a liquid crystal cell (VA mode, OCB mode, HAN mode) with many cylindrical liquid crystallinity molecules which are carrying out orientation perpendicularly substantially, it can compensate optically effectively. However, according to research of this invention person, even if it uses a discotheque liquid crystallinity molecule, it is very difficult [it] to compensate a liquid crystal cell optically completely satisfactory. The purpose of this invention is offering the optical compensation sheet with which a liquid crystal cell with many cylindrical liquid crystallinity molecules which are carrying out orientation perpendicularly substantially can be compensated optically correctly.

[0006]

[Means for Solving the Problem] the purpose of this invention -- the optical compensation sheet of following the (1) - (5), and the following -- it was attained by the liquid crystal display of (the elliptically-polarized-light plate of 6), and following (7).

(1) The optical compensation sheet with which it is the optical compensation sheet which has the optical anisotropy layer formed from the transparence base material and the discotheque liquid crystallinity molecule, a transparence base material has optical optically uniaxial or optical optically biaxial, and the average tilt angle between the disk side of a discotheque liquid crystallinity molecule and a transparence base material side is characterized by the discotheque liquid crystallinity molecule carrying out orientation in the less than 5-degree condition.

[0007] (2) An optical compensation sheet given in (1) in which a transparence base material has the retardation within a field (R_e) defined as 10 thru/or the range of 1000nm by the following formula.

n_x and n_y are the refractive indexes within a field of a transparence base material among an $R_e = (n_x - n_y) \cdot d$ type, and d is the thickness of a transparence base material.

(3) An optical compensation sheet given in (1) in which a transparence base material has the retardation (R_{th}) of the thickness direction defined as 10 thru/or the range of 1000nm by the following formula.

n_x and n_y are the refractive indexes within a field of a transparence base material among a $R_{th} = [(n_x + n_y) / 2] - n_z$ type, and n_z is the refractive index of the thickness direction of a transparence base material, and d is the thickness of a transparence base material.

(4) An optical compensation sheet given in (1) in which an optical compensation sheet has the retardation within a field (R_e) defined as 20 thru/or the range of 200nm by the following formula. n_x and n_y are the refractive indexes within a field of an optical compensation sheet among an $R_e = (n_x - n_y) \cdot d$ type, and d is the thickness of an optical compensation sheet.

(5) An optical compensation sheet given in (1) in which an optical compensation sheet has the retardation (R_{th}) of the thickness direction defined as 70 thru/or the range of 500nm by the following formula.

n_x and n_y are the refractive indexes within a field of an optical compensation sheet among a $R_{th} = [(n_x + n_y) / 2] - n_z$ type, and n_z is the refractive index of the thickness direction of an optical compensation sheet, and d is the thickness of an optical compensation sheet.

[0008] (6) The elliptically-polarized-light plate with which it is the elliptically-polarized-light plate which has the optical anisotropy layer, polarization film, and transparence protective coat which were formed from the transparence base material and the discotheque liquid crystallinity molecule, a transparence base material has optical optically uniaxial or optical optically biaxial, and the average tilt angle between the disk side of a discotheque liquid crystallinity molecule and

a transparence base material side is characterized by the discotheque liquid crystallinity molecule carrying out orientation in the less than 5-degree condition.

(7) It is the liquid crystal display which consists of a polarizing element of two sheets arranged at the liquid crystal cell in VA mode, and its both sides. The optical anisotropy layer in which at least one side of a polarizing element was formed from the transparence base material and the discotheque liquid crystallinity molecule, Are the elliptically-polarized-light plate which has the polarization film and a transparence protective coat, and a transparence base material has optical optically uniaxial or optical optically biaxial. And the liquid crystal display with which the average tilt angle between the disk side of a discotheque liquid crystallinity molecule and a transparence base material side is characterized by the discotheque liquid crystallinity molecule carrying out orientation in the less than 5-degree condition.

[0009]

[Effect of the Invention] As for this invention person, the average tilt angle between the transparence base material which has optical optically uniaxial or optical optically biaxial, and the disk side of a discotheque liquid crystallinity molecule and a transparence base material side succeeded in a discotheque liquid crystallinity molecule compensating correctly optically a liquid crystal cell with many cylindrical liquid crystallinity molecules which are carrying out orientation perpendicularly substantially by using together the optical anisotropy layer which is carrying out orientation in the less than 5-degree condition as a result of research. It was going to compensate optically with the Prior art the liquid crystal cell with many cylindrical liquid crystallinity molecules which are carrying out orientation perpendicularly substantially only by the optical anisotropy of a discotheque liquid crystallinity molecule. Although there are various orientation gestalten in a discotheque liquid crystallinity molecule, there is a limit also in optical compensation of a liquid crystal cell only by the discotheque liquid crystallinity molecule. By this invention, it can respond to the optical property of a liquid crystal cell with many cylindrical liquid crystallinity molecules which are carrying out orientation perpendicularly substantially correctly by using the optical anisotropy of the transparence base material with which an average tilt angle has optical optically uniaxial or optical optically biaxial in the less than 5-degree condition in addition to the optical anisotropy of the discotheque liquid crystallinity molecule which is carrying out orientation (it compensates optically). Moreover, in addition to the liquid crystal cell, the polarization film also has the viewing-angle property. According to research of this invention person, use of the transparence base material which has optical optically uniaxial or optical optically biaxial (preferably optical optically biaxial) is effective in viewing-angle compensation of the polarization film.

[0010]

[Embodiment of the Invention] Drawing 1 is the mimetic diagram showing the fundamental configuration of a transparency mold liquid crystal display. The transparency mold liquid crystal display shown in (a) of drawing 1 sequentially from a back light (BL) side A transparence protective coat (1a), the polarization film (2a), a transparence base material (3a), an optical anisotropy layer (4a). It consists of the bottom substrate of a liquid crystal cell (5a), a cylindrical liquid crystallinity molecule (6), the upper substrate (5b) of a liquid crystal cell, an optical anisotropy layer (4b), a transparence base material (3b), polarization film (2b), and a transparence protective coat (1b). A transparence base material and an optical anisotropy layer (3a-4a, and 4b-3b) constitute an optical compensation sheet. And a transparence protective coat, the polarization film, a transparence base material, and an optical anisotropy layer (1a-4a, and 4b-1b) constitute a elliptically-polarized-light plate. The transparency mold liquid crystal display shown in (b) of drawing 1 sequentially from a back light (BL) side It consists of a transparence protective coat (1a), the polarization film (2a), a transparence base material (3a), an optical anisotropy layer (4a), the bottom substrate of a liquid crystal cell (5a), a cylindrical liquid crystallinity molecule (6), the upper substrate (5b) of a liquid crystal cell, a transparence protective coat (1b), polarization film (2b), and a transparence protective coat (1c). A transparence base material and an optical anisotropy layer (3a-4a) constitute an optical compensation sheet. And a transparence protective coat, the polarization film, a transparence base material, and an optical anisotropy layer (1a-4a) constitute a elliptically-polarized-light

plate.

[0011] The transparency mold liquid crystal display shown in (c) of drawing 1 sequentially from a back light (BL) side It consists of a transparence protective coat (1a), the polarization film (2a), a transparence protective coat (1b), the bottom substrate of a liquid crystal cell (5a), a cylindrical liquid crystallinity molecule (6), the upper substrate (5b) of a liquid crystal cell, an optical anisotropy layer (4b), a transparence base material (3b), polarization film (2b), and a transparence protective coat (1c). A transparence base material and an optical anisotropy layer (4b-3b) constitute an optical compensation sheet. And a transparence protective coat, the polarization film, a transparence base material, and an optical anisotropy layer (4b-1c) constitute a elliptically-polarized-light plate. Drawing 2 is the mimetic diagram showing the fundamental configuration of a reflective mold liquid crystal display. The reflective mold liquid crystal display shown in drawing 2 becomes order from the bottom substrate of a liquid crystal cell (5a), a reflecting plate (RP), a cylindrical liquid crystallinity molecule (6), the upper substrate (5b) of a liquid crystal cell, an optical anisotropy layer (4), a transparence base material (3), the polarization film (2), and a transparence protective coat (1) from the bottom. A transparence base material and an optical anisotropy layer (4-3) constitute an optical compensation sheet. And a transparence protective coat, the polarization film, a transparence base material, and an optical anisotropy layer (4-1) constitute a elliptically-polarized-light plate. In addition, in drawing 1 - drawing 2, even if reverse in the sequence [base material / transparence / an optical anisotropy layer (4) and / (3)] of arrangement, it is good.

[0012] In [transparence base material] this invention, the transparence base material which has optical optically uniaxial or optical optically biaxial is used. It means that light transmittance is 80% or more as a base material is transparent. In the case of an optical optically uniaxial base material, it may be forward (it is size from the refractive index of the direction where the refractive index of the direction of an optical axis is perpendicular to an optical axis) optically, or you may be negative (it is smallness from the refractive index of the direction where the refractive index of the direction of an optical axis is perpendicular to an optical axis). In the case of an optical optically biaxial base material, the refractive indexes n_x , n_y , and n_z of a transparence base material become an altogether different value ($n_x \neq n_y \neq n_z$). It is desirable that they are 10 thru/or 1000nm, as for the retardation within a field of the transparence base material which has optical optically uniaxial or optical optically biaxial (R_e), it is still more desirable that they are 15 thru/or 300nm, and it is most desirable that they are 20 thru/or 200nm. It is desirable that they are 10 thru/or 1000nm, as for the retardation (R_{th}) of the thickness direction of the transparence base material which has optical optically uniaxial or optical optically biaxial, it is more desirable that they are 15 thru/or 300nm, and it is still more desirable that they are 20 thru/or 200nm. The retardation within a field of a transparence base material (R_e) and the retardation (R_{th}) of the thickness direction are defined by the following type, respectively.

n_x and n_y are the refractive indexes within a field of a transparence base material among an $R_e = (n_x - n_y) \times d$ type, and n_z is the refractive index of the thickness direction of a transparence base material, and d is the thickness of a transparence base material.

[0013] Generally as a transparence base material which has optical anisotropy, a synthetic polymer (an example, a polycarbonate, polysulfone, polyether sulphone, polyacrylate, polymethacrylate, norbornene resin) is used. However, the fall of whenever [use / of (1) retardation rise agent indicated by the Europe JP,0911656,B A No. 2 specification /, and acetylation / of (2) cellulose acetate] or manufacture of the film by (3) cooling solution process, The cellulose ester film which has optical anisotropy can also be manufactured. As for the transparence base material which consists of a polymer film, forming by the solvent cast method is desirable.

[0014] In order to obtain optical optically uniaxial or optical optically biaxial, it is desirable to carry out extension processing on a polymer film. What is necessary is just to carry out usual uniaxial-stretching processing or biaxial-stretching processing, when manufacturing an optical optically uniaxial base material. When manufacturing an optical optically biaxial base material, it is desirable to carry out imbalance biaxial-stretching processing. imbalance biaxial stretching — a

polymer film -- a certain direction -- fixed scale-factor (for example, 3 thru/or 100%, preferably 5 thru/or 30%) extension -- carrying out -- a direction perpendicular to it -- more than it -- scale-factor (for example, 6 thru/or 200%, preferably 10 thru/or 90%) extension is carried out. Extension processing of two directions may be carried out to coincidence. As for the extension direction (direction where draw magnification is high in imbalance biaxial stretching), and the lagging axis within the field of the film after extension, it is desirable to become substantial in the same direction. It is desirable that it is less than 10 degrees, as for the include angle of the extension direction and a lagging axis, it is still more desirable that it is less than 5 degrees, and it is most desirable that it is less than 3 degrees.

[0015] The laminating of the transparence base material which has optical optically uniaxial or optical optically biaxial, and the transparence base material (an example, cellulose acetate film) which has the optical isotropy may be carried out. As for the thickness of a transparence base material, it is desirable that they are 10 thru/or 500 micrometers, and it is still more desirable that they are 50 thru/or 200 micrometers. In order to improve adhesion with a transparence base material and the layer (a glue line, the orientation film, or optical anisotropy layer) prepared on it, surface treatment (an example, glow discharge processing, corona discharge treatment, ultraviolet-rays (UV) processing, flame treatment) may be carried out to a transparence base material. An ultraviolet ray absorbent may be added to a transparence base material. A glue line (under coat) may be prepared on a transparence base material. About a glue line, JP,7-333433,A has a publication. As for the thickness of a glue line, it is desirable that they are 0.1 thru/or 2 micrometers, and it is still more desirable that they are 0.2 thru/or 1 micrometer.

[0016] The [orientation film] orientation film is a means like accumulation of the organic compound (an example, omega-tricosane acid, dioctadecyl methylanmmmonium chloride, stearyl acid methyl) by rubbing processing of an organic compound (preferably polymer), the method vacuum evaporatono of slanting of an inorganic compound, formation of the layer which has a micro groove, or the Langmuir-Blodgett's technique (LB film), and can be prepared. Furthermore, the orientation film which an orientation function produces is also known by grant of electric field, grant of a magnetic field, or optical exposure. Especially the orientation film formed by rubbing processing of a polymer is desirable. Rubbing processing is carried out by rubbing the front face of a polymer layer several times in the fixed direction with paper or cloth. In order for an average tilt angle to carry out orientation of the discotheque liquid crystallinity molecule in the less than 5-degree condition, it is desirable to use for the orientation film the polymer (the usual polymer for orientation film) to which surface energy of the orientation film is not reduced. As for the thickness of the orientation film, it is desirable that they are 0.01 thru/or 5 micrometers, and it is still more desirable that they are 0.05 thru/or 1 micrometer. In addition, since orientation of the discotheque liquid crystallinity molecule of an optical anisotropy layer is carried out using the orientation film, an optical anisotropy layer may be imprinted on a transparence base material. Even if the discotheque liquid crystallinity molecule fixed in the state of orientation does not have the orientation film, it can maintain an orientation condition. Moreover, in order for an average tilt angle to carry out orientation of the discotheque liquid crystallinity molecule in the less than 5-degree condition by this invention, it is not necessary to carry out rubbing processing, and the orientation film is also unnecessary depending on the case. However, a liquid crystallinity molecule and the orientation film (JP,9-152509,A publication) which forms a chemical bond may be used by the interface in order to improve the adhesion of a liquid crystallinity molecule and a transparence base material. When using the orientation film for the purpose of an adhesion improvement, it is not necessary to carry out rubbing processing.

[0017] A [optical anisotropy layer] optical anisotropy layer is formed from a discotheque liquid crystallinity molecule. The average tilt angle between the disk side of a discotheque liquid crystallinity molecule and a transparence base material side carries out orientation of the discotheque liquid crystallinity molecule in the less than 5-degree condition. As a result of having combined the transparence base material which has optically biaxial [which was mentioned above / optical optically uniaxial or optical optically biaxial], and the discotheque liquid crystallinity molecule in which the average tilt angle is carrying out orientation in the less than 5-degree condition, it is desirable that they are 20 thru/or 200nm, as for the retardation

within a field of the whole optical compensation sheet (Re), it is still more desirable that they are 20 thru/or 100nm, and it is most desirable that they are 20 thru/or 70nm. It is desirable that they are 70 thru/or 500nm, as for the retardation (Rth) of the thickness direction of the whole optical compensation sheet, it is more desirable that it is 300m of 70 **, and it is still more desirable that they are 70 thru/or 200nm. The retardation within a field of an optical compensation sheet (Re) and the retardation (Rth) of the thickness direction are defined by the following type, respectively.

n_x and n_y are the refractive indexes within a field of an optical compensation sheet among an $Re=(n_x-n_y) \times d$ type, and n_z is the refractive index of the thickness direction of an optical compensation sheet, and d is the thickness of an optical compensation sheet.

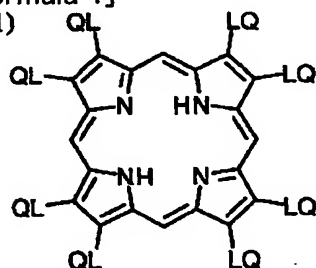
[0018] As for a discotheque liquid crystallinity molecule, being fixed in the condition of carrying out orientation is desirable. Although an orientation condition is also fixable using a polymer binder, fixing by the polymerization reaction is desirable. reference (C. — the volume Destradet et al., Mol.Cryst.Liq.Cryst., vol.71, and for page 111 (1981); Chemical Society of Japan —) with various discotheque liquid crystallinity molecules Quarterly Chemistry Survey, No.22, the chemistry of liquid crystal, Chapter 5, The Chapter 10 second article (1994); B.Kohne et al. and Angew.Chem. It is indicated by Soc.Chem.Comm., page 1794;(1985) J.Zhang et al., J.Am.Chem.Soc., vol.116, and page 2655 (1994). About the polymerization of a discotheque liquid crystallinity molecule, a JP,8-27284,A official report has a publication. In order to fix a discotheque liquid crystallinity molecule by the polymerization, it is necessary to combine a polymerization nature machine with the disc-like core of a discotheque liquid crystallinity molecule as a substituent. However, if a polymerization nature machine is made to link with a disc-like core directly, it will become difficult to maintain an orientation condition in a polymerization reaction. Then, a connection radical is introduced between a disc-like core and a polymerization nature machine. Therefore, as for a discotheque liquid crystallinity molecule, it is desirable that it is the compound expressed with the following type (I).

[0019] (I) Among $D(-L-Q)_n$ type, D is a disc-like core,;L is the connection radical of bivalence,;Q is a polymerization nature machine, and; and n are the integers of 4 thru/or 12. The example of the disc-like core (D) of the above-mentioned formula is shown below. In each following example, LQ (or QL) means the combination of the connection radical (L) of bivalence, and a polymerization nature machine (Q).

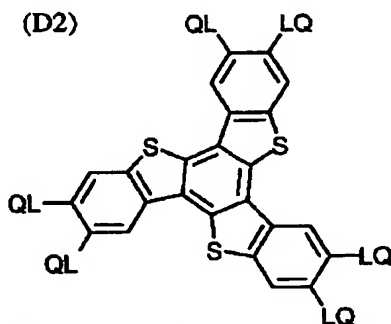
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[Formula 1]

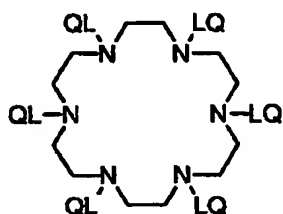
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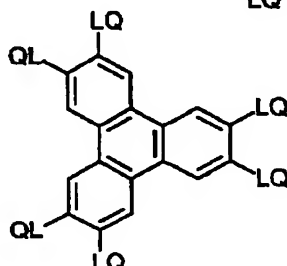
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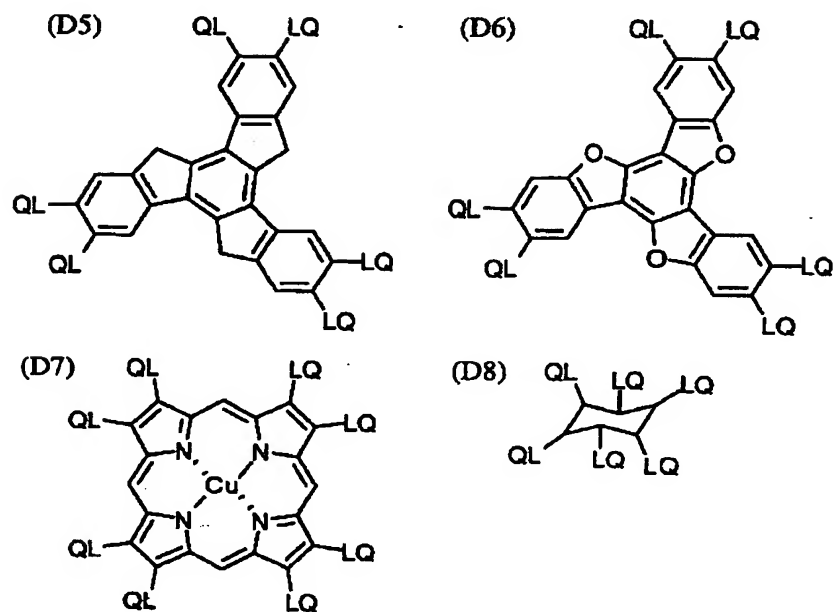


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[0021]

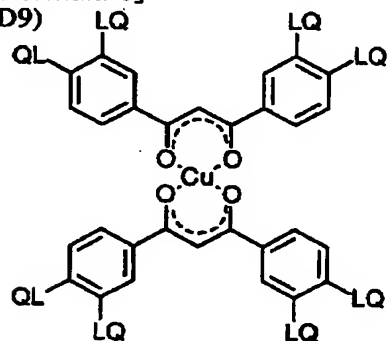
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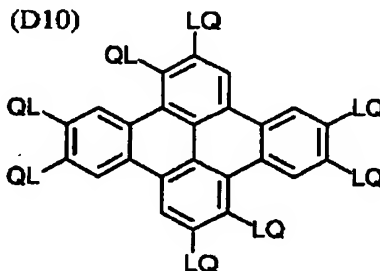
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[Formula 3]

(D9)



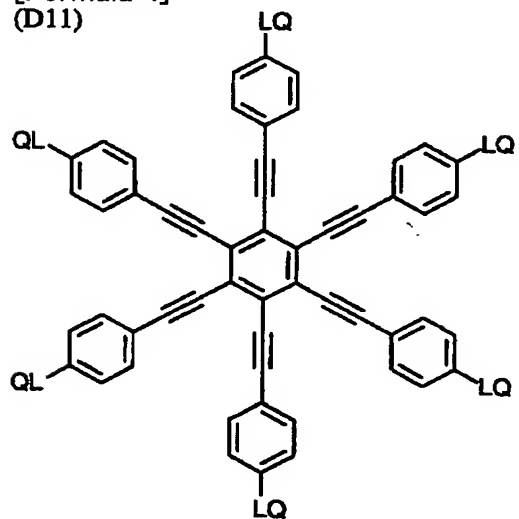
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[0023]

[Formula 4]

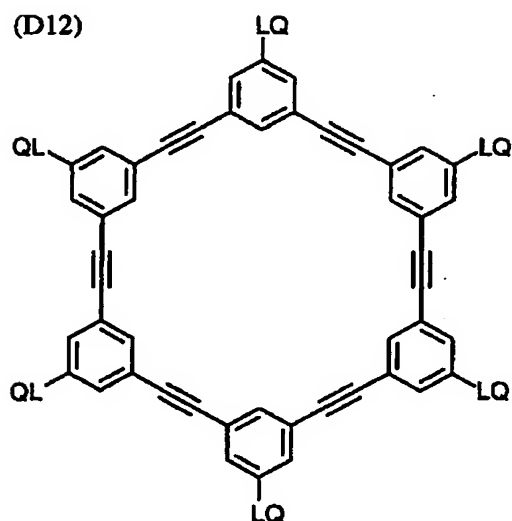
(D11)



[0024]

[Formula 5]

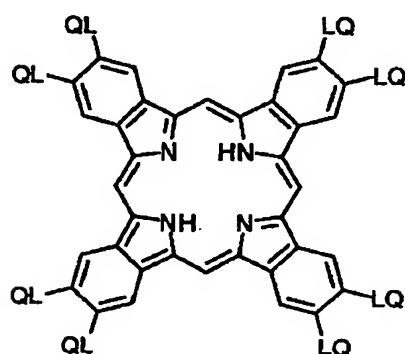
(D12)



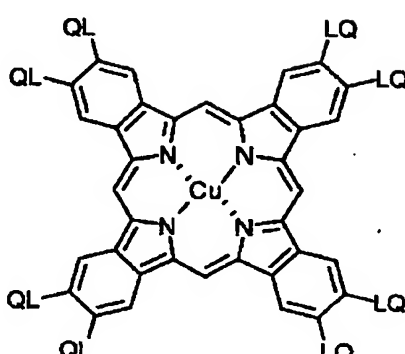
[0025]

[Formula 6]

(D13)



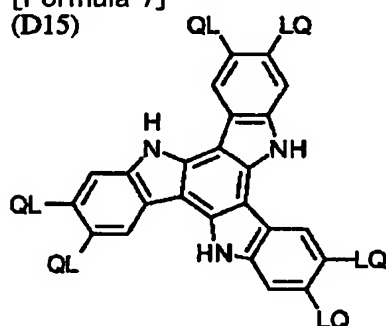
(D14)



[0026]

[Formula 7]

(D15)



[0027] As for the connection radical (L) of bivalence, in the above-mentioned formula, it is desirable that it is the connection radical of the bivalence chosen from the group which consists of an alkylene group, an alkenylene group, an arylene radical, -CO-, -NH-, -O-, -S-, and those combination. As for the connection radical (L) of bivalence, it is still more desirable that it is the radical which combined at least two radicals of the bivalence chosen from the group which consists of an alkylene group, an alkenylene group, an arylene radical, -CO-, -NH-, -O-, and -S-. As for the connection radical (L) of bivalence, it is most desirable that it is the radical which combined at least two radicals of the bivalence chosen from the group which consists of alkylene group, alkenylene group, arylene radical, and -CO- and -O-. As for the carbon atomic number of an alkylene group, it is desirable that it is 1 thru/or 12. As for the carbon atomic number of an alkenylene group, it is desirable that it is 2 thru/or 12. As for the carbon atomic number of an

arylene radical, it is desirable that it is 6 thru/or 10. The alkylene group, the alkenylene group, and the arylene radical may have the substituent (an example, an alkyl group, a halogen atom, a cyano ** alkoxy group, acyloxy radical). The example of the connection radical (L) of bivalence is shown below. Left-hand side combines with a disc-like core (D), and right-hand side combines with a polymerization nature machine (Q). AL means an alkylene group or an alkenylene group, and AR means an arylene radical.

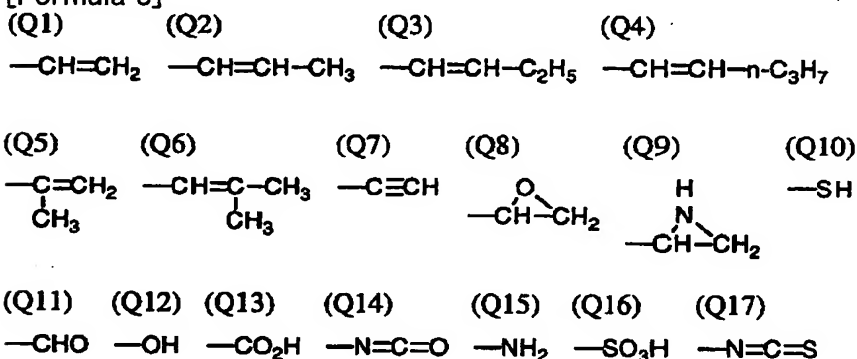
[0028] L1: - AL-CO-O-AL-L2: - AL-CO-O-AL-O-L3: - AL-CO-O-AL-O-AL-L4: - AL-CO-O-AL-O-CO-L5: - CO-AR-O-AL-L6: - CO-AR-O-AL-O-L7: - CO-AR-O-AL-O-CO-L8: - CO-NH-AL-L9: - NH-AL-O-L10: - NH-AL-O-CO-L11: - O-AL-L12: - O-AL-O-L13: - O-AL-O-CO-[0029]

L14: - O-AL-O-CO-NH-AL-L15: - O-AL-S-AL-L16: - O-CO-AL-AR-O-AL-O-CO-L17: - O-CO-AR-O-AL-CO-L18: - O-CO-AR-O-AL-O-CO-L19: - O-CO-AR-O-AL-O-AL-O-CO-L20: - O-CO-AR-O-AL-O-AL-O-AL-O-CO-L21: - S-AL-L22: - S-AL-O-L23: - S-AL-O-CO-L24: - S-AL-S-AL-L25: - S-AR-AL-[0030]

The polymerization nature machine (Q) of a formula (I) is determined according to the class of polymerization reaction. The example of a polymerization nature machine (Q) is shown below.

[0031]

[Formula 8]



[0032] It is desirable that they are a partial saturation polymerization nature machine (Q1-Q7), an epoxy group (Q8), or an aziridinyl radical (Q9), as for a polymerization nature machine (Q), it is still more desirable that it is a partial saturation polymerization nature machine, and it is most desirable that it is an ethylene nature partial saturation polymerization nature machine (Q1-Q6). In a formula (I), n is the integer of 4 thru/or 12. A concrete figure is determined according to the class of discotheque core (D). In addition, although the combination of two or more L and Q may differ, its same thing is desirable.

[0033] Two or more kinds of discotheque liquid crystallinity molecules may be used together. For example, a polymerization nature discotheque liquid crystallinity molecule and a non-polymerization nature discotheque liquid crystallinity molecule which were described above can be used together. As for a non-polymerization nature discotheque liquid crystallinity molecule, it is desirable that it is the compound which changed into the hydrogen atom or the alkyl group the polymerization nature machine (Q) of the polymerization nature discotheque liquid crystallinity molecule mentioned above. That is, as for a non-polymerization nature discotheque liquid crystallinity molecule, it is desirable that it is the compound expressed with the following type (Ia).

(Ia) Among D(-L-R) n type, D is a disc-like core, L is the connection radical of bivalence, R is a hydrogen atom or an alkyl group, and; and n are the integers of 4 thru/or 12. The example of the disc-like core (D) of a formula (Ia) is the same as the example of the aforementioned polymerization nature discotheque liquid crystal molecule except changing LQ (or QL) into LR (or RL). Moreover, the example of the connection radical (L) of bivalence is the same as the example of the aforementioned polymerization nature discotheque liquid crystal molecule. As for the alkyl group of R, it is desirable that carbon atomic numbers are 1 thru/or 40, and it is still more desirable that it is 1 thru/or 30. The chain-like alkyl group is more desirable than an annular alkyl group, and the straight chain-like alkyl group is more desirable than the chain-like

alkyl group which has branching. As for R, it is desirable that a hydrogen atom or a carbon atomic number is especially the straight chain-like alkyl group of 1 thru/or 30.

[0034] In order for the average tilt angle of the disk side of a discotheque liquid crystallinity molecule and a transparence base material side to carry out orientation of the discotheque liquid crystallinity molecule in the less than 5-degree condition, it is desirable to use a discotheque liquid crystallinity molecule and the compound which can carry out phase separation in the amount of the fixed range. The compound which has the lower-fatty-acid ester, fluorine-containing surface active agent, and 1,3,5-triazine ring of a cellulose is contained in a discotheque liquid crystallinity molecule and the compound which can carry out phase separation.

[0035] As for the "lower fatty acid" in the lower-fatty-acid ester of a cellulose, a carbon atomic number means six or less fatty acid. As for a carbon atomic number, it is desirable that it is 2 thru/or 5, and it is still more desirable that it is 2 thru/or 4. The substituent (an example, hydroxy) may combine with the fatty acid. Two or more kinds of fatty acids may form a cellulose and ester. Cellulose acetate, cellulose propionate, cellulose butyrate, cellulose hydroxy propionate, cellulose acetate propionate, and cellulose acetate butylate are contained in the example of the lower-fatty-acid ester of a cellulose. Especially cellulose acetate butylate is desirable. As for whenever [butyryl-ized / of cellulose acetate butylate], it is desirable that it is 30% or more, and it is still more desirable that they are 30 thru/or 80%. As for whenever [acetylation / of cellulose acetate butylate], it is desirable that it is 30% or less, and it is still more desirable that they are 1 thru/or 30%. It is desirable to use it in 0.01 thru/or 1% of the weight of the amount of the amount of a discotheque liquid crystallinity molecule, as for the lower-fatty-acid ester of a cellulose, it is still more desirable to use it in 0.1 thru/or 1% of the weight of an amount, and it is most desirable to use it in 0.3 thru/or 0.9% of the weight of an amount. The coverage of the lower-fatty-acid ester of a cellulose is 1 thru/or 500 mg/m². It is desirable that it is the range and they are 3 thru/or 300 mg/m². It is still more desirable that it is the range and they are 5 thru/or 200 mg/m². It is most desirable that it is the range.

[0036] A fluorine-containing surface active agent consists of a connection radical prepared in the hydrophilic radical and arbitration of the hydrophobic radical containing a fluorine atom, nonionicity, anionic, cationicity, or both sexes. The fluorine-containing surfactant which consists of one hydrophobic radical and one hydrophilic radical is expressed with the following formula (II).

[0037] (II) The inside of a Rf-L3-Hy type and Rf are the hydrocarbon residue of the monovalence permuted by the fluorine atom, and are; L3. It is single bond or the connection radical of bivalence, and; and Hy are hydrophilic radicals. Rf of a formula (II) functions as a hydrophobic radical. As for hydrocarbon residue, it is desirable that they are an alkyl group or an aryl group. As for the carbon atomic number of an alkyl group, it is desirable that it is 3 thru/or 30, and, as for the carbon atomic number of an aryl group, it is desirable that it is 6 thru/or 30. A part or all of a hydrogen atom that is contained in hydrocarbon residue is permuted by the fluorine atom. It is more desirable to permute 60% or more, it is desirable to permute 50% or more of the hydrogen atom contained in hydrocarbon residue by the fluorine atom, and it is [it is still more desirable to permute 70% or more, and] most desirable to permute 80% or more. The remaining hydrogen atoms may be permuted by the halogen atom (an example, a chlorine atom, bromine atom) of further others. The example of Rf is shown below.

[0038] Rf1:n-C8 F17-Rf2:n-C6 F13-Rf3:Cl-(CF2-CFCl) 3 - CF2-Rf 4:H-(CF2) 8 - Rf5:H-(CF2) 10-Rf6:n-C9 F19-Rf7 : Pentafluorophenyl Rf8:n-C7 F15-Rf9:Cl-(CF2-CFCl)2-CF2-Rf10:H-(CF2)4-Rf11:H-(CF2)6-Rf12:Cl-(CF2)6-Rf13:C3 F7-[0039] As for the connection radical of bivalence, in a formula (II), it is desirable that it is the connection radical of the bivalence chosen from the group which consists of an alkylene group, an arylene radical, the heterocycle residue of bivalence, -CO-, -NR- (a carbon atomic number is the alkyl group or hydrogen atom of 1 thru/or 5 for R), -O-, -SO2-, and those combination. L3 of a formula (II) An example is shown below. Left-hand side combines with a hydrophobic radical (Rf), and right-hand side combines with a hydrophilic radical (Hy). In AL, an alkylene group and AR mean an arylene radical and Hc means the heterocycle residue of bivalence. In addition, an alkylene group, an arylene radical, and

the heterocycle residue of bivalence may have the substituent (an example, alkyl group).

[0040] L0 : Single bond L31:-SO₂-NR-L32:-AL-O-L33:-CO-NR-L34:-AR-O-L35:-SO₂-NR-AL-CO-O-L36:-CO-O-L37:-SO₂-NR-AL-O-L38:-SO₂ - NR-AL-L39:-CO-NR-AL-L40:-AL1-O-AL2-L41:-Hc-AL-L42:-SO₂-NR-AL1-O-AL2-L43:-AR-L44:-O-AR-SO₂-NR-AL-L45:-O-AR-SO₂ - NR-L46:-O-AR-O-[0041] H(ies) of a formula (II) are either a nonionic hydrophilic radical, an anionic hydrophilic radical, cationic hydrophilic radicals or those combination (both-sexes hydrophilic radical). Especially a nonionic hydrophilic radical is desirable. The example of Hy of a formula (II) is shown below.

[0042] Hy1: -(CH₂ CH₂ O) n-H (n is the integer of 5 thru/or 30)

Hy2: -(CH₂ CH₂ O) n-R1 (for the integer of 5 thru/or 30, and R1, a carbon atomic number is [n] the alkyl group of 1 thru/or 6)

Hy3: -(CH₂ CHOHCH₂) n-H (n is the integer of 5 thru/or 30)

Hy4: -COOM (M is a hydrogen atom, an alkali-metal atom, or a dissociation condition)

Hy5: -SO₃ M (M is a hydrogen atom, an alkali-metal atom, or a dissociation condition)

Hy6: -(CH₂ CH₂ O) n-CH₂ CH₂ CH₂-SO₃ M (n is the integer of 5 thru/or 30 and M is a hydrogen atom or an alkali-metal atom)

Hy7: -OPO(OH)₂Hy8:-N⁺3 (CH₃) and X - (X is a halogen atom)

Hy9: -COONH₄ [0043] A nonionic hydrophilic radical (Hy1, Hy2, Hy3) is desirable, and the hydrophilic radical (Hy1) which consists of polyethylene oxide is the most desirable. It is the example of a fluorine-containing surfactant expressed with a formula (II) The above Rf and L3 And the example of Hy is quoted and shown.

[0044] FS-1:Rf1-L31(R=C₃ H₇)-Hy1(n=6)

FS-2:Rf1-L31(R=C₃ H₇)-Hy1(n=11)

FS-3:Rf1-L31(R=C₃ H₇)-Hy1(n=16)

FS-4:Rf1-L31(R=C₃ H₇)-Hy1(n=21)

FS-5:Rf1-L31(R=C₂ H₅)-Hy1(n=6)

FS-6:Rf1-L31(R=C₂ H₅)-Hy1(n=11)

FS-7:Rf1-L31(R=C₂ H₅)-Hy1(n=16)

FS-8:Rf1-L31(R=C₂ H₇)-Hy1(n=21)

FS-9:Rf2-L31(R=C₃ H₇)-Hy1(n=6)

FS-10:Rf2-L31(R=C₃ H₇)-Hy1(n=11)

FS-11:Rf2-L31(R=C₃ H₇)-Hy1(n=16)

FS-12:Rf2-L31(R=C₃ H₇)-Hy1(n=21)

FS-13:Rf3-L32(AL=CH₂)-Hy1(n=5)

FS-14:Rf3-L32(AL=CH₂)-Hy1(n=10)

FS-15:Rf3-L32(AL=CH₂)-Hy1(n=15)

FS-16:Rf3-L32(AL=CH₂)-Hy1(n=20)

FS-17:Rf4-L33(R=C₃ H₇)-Hy1(n=7)

FS-18:Rf4-L33(R=C₃ H₇)-Hy1(n=13)

FS-19:Rf4-L33(R=C₃ H₇)-Hy1(n=19)

FS-20:Rf4-L33(R=C₃ H₇)-Hy1(n=25)

[0045] FS-21:Rf5-L32(AL=CH₂)-Hy1(n=11)

FS-22:Rf5-L32(AL=CH₂)-Hy1(n=15)

FS-23:Rf5-L32(AL=CH₂)-Hy1(n=20)

FS-24:Rf5-L32(AL=CH₂)-Hy1(n=30)

FS-25: Rf6-L34(AR=p-phenylene)-Hy1 (n= 11)

FS-26: Rf6-L34(AR=p-phenylene)-Hy1 (n= 17)

FS-27: Rf6-L34(AR=p-phenylene)-Hy1 (n= 23)

FS-28: Rf6-L34(AR=p-phenylene)-Hy1 (n= 29)

FS-29: Rf1-L35(R=C three H₇ and AL=CH₂)-Hy1 (n= 20)

FS-30: Rf1-L35(R=C three H₇ and AL=CH₂)-Hy1 (n= 30)

FS-31: Rf1-L35(R=C three H₇ and AL=CH₂)-Hy1 (n= 40)

FS-32:Rf1-L36-Hy1(n=5)

FS-33:Rf1-L36-Hy1(n=10)

FS-34:Rf1-L36-Hy1(n=15)

FS-35:Rf1-L36-Hy1(n=20)

FS-36:Rf7-L36-Hy1(n=8)

FS-37:Rf7-L36-Hy1(n=13)

FS-38:Rf7-L36-Hy1(n=18)

FS-39:Rf7-L36-Hy1(n=25)

[0046] FS-40:Rf1-L0-Hy1(n=6)

FS-41:Rf1-L0-Hy1(n=11)

FS-42:Rf1-L0-Hy1(n=16)

FS-43:Rf1-L0-Hy1(n=21)

FS-44: Rf1-L31(R=C three H7)-Hy2 (n= 7 and R1 =C two H5)

FS-45: Rf1-L31(R=C three H7)-Hy2 (n= 13 and R1 =C two H5)

FS-46: Rf1-L31(R=C three H7)-Hy2 (n= 20 and R1 =C two H5)

FS-47: Rf1-L31(R=C three H7)-Hy2 (n= 28 and R1 =C two H5)

FS-48:Rf8-L32(AL=CH2)-Hy1(n=5)

FS-49:Rf8-L32(AL=CH2)-Hy1(n=10)

FS-50:Rf8-L32(AL=CH2)-Hy1(n=15)

FS-51:Rf8-L32(AL=CH2)-Hy1(n=20)

FS-52: Rf1-L37(R=C three H7, AL=CH2CH2)-Hy3 (n= 5)

FS-53: Rf1-L37(R=C three H7, AL=CH2CH2)-Hy3 (n= 7)

FS-54: Rf1-L37(R=C three H7, AL=CH2CH2)-Hy3 (n= 9)

FS-55: Rf1-L37(R=C three H7, AL=CH2CH2)-Hy3 (n= 12)

FS-56:Rf9-L0-Hy4(M=H)

FS-57:Rf3-L0-Hy4(M=H)

FS-58: Rf1-L38(R=C three H7 and AL=CH2)-Hy4 (M=K)

FS-59: Rf4-L39(R=C three H7 and AL=CH2)-Hy4 (M=Na)

[0047] FS-60:Rf1-L0-Hy5(M=K)

FS-61: Rf10-L40(AL1 =CH2, AL2 =CH2CH2)-Hy5 (M=Na)

FS-62: Rf11-L40(AL1 =CH2, AL2 =CH2CH2)-Hy5 (M=Na)

FS-63: Rf5-L40(AL1 =CH2, AL2 =CH2CH2)-Hy5 (M=Na)

FS-64: Rf1-L38(R=C3H7 and AL=CH2CH2CH2)-Hy5(M=Na) FS-65:Rf1-L31(R=C three H7)-Hy6 (n= 5, M=Na)

FS-66: Rf1-L31(R=C three H7)-Hy6 (n= 10, M=Na)

FS-67: Rf1-L31(R=C three H7)-Hy6 (n= 15, M=Na)

FS-68: Rf1-L31(R=C three H7)-Hy6 (n= 20, M=Na)

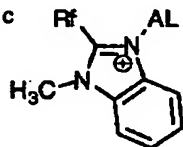
FS-69: Rf1-L38(R=C two H5 and AL=CH2 CH2)-Hy7FS-70:Rf1-L38(R=H and AL=CH2CH2CH2)-Hy8 (X=I)

FS-71: Rf11-L41(following Hc and AL=CH2CH2CH2)-Hy6 (M dissociates)

[0048]

[Formula 9]

FS-71のHc



[0049] FS-72: Rf1-L42(R=C3H7, AL1=CH2CH2, AL2=CH2CH2CH2)-Hy6(M=Na) FS-73:Rf12-L0-Hy5 (M=Na)

FS-74: Rf13-L43(AR=o-phenylene)-Hy6 (M=K)

FS-75: Rf13-L43(AR=m-phenylene)-Hy6 (M=K)

FS-76: Rf13-L43(AR=p-phenylene)-Hy6 (M=K)

FS-77: Rf6-L44(R=C2H5, AL=CH2CH2)-Hy5 (M=H)

FS-78: Rf6-L45(AR=p-phenylene, R=C2H5)-Hy1 (n= 9)

FS-79: Rf6-L45(AR=p-phenylene, R=C2H5)-Hy1 (n= 14)

FS-80: Rf6-L45(AR=p-phenylene, R=C₂H₅)-Hy1 (n= 19)

FS-81: Rf6-L45(AR=p-phenylene, R=C₂H₅)-Hy1 (n= 28)

FS-82: Rf6-L46(AR=p-phenylene)-Hy1 (n= 5)

FS-83: Rf6-L46(AR=p-phenylene)-Hy1 (n= 10)

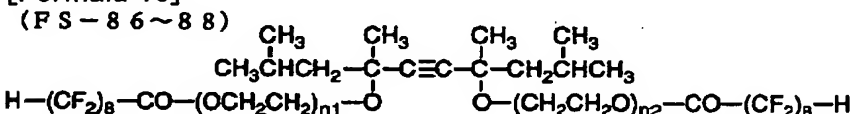
FS-84: Rf6-L46(AR=p-phenylene)-Hy1 (n= 15)

FS-85: Rf6-L46(AR=p-phenylene)-Hy1 (n= 20)

[0050] The fluorine-containing surfactant which has the hydrophobic radical or hydrophilic radical containing a fluorine atom two or more may be used. The example of the fluorine-containing surfactant which has two or more hydrophobic radicals or a hydrophilic radical is shown below.

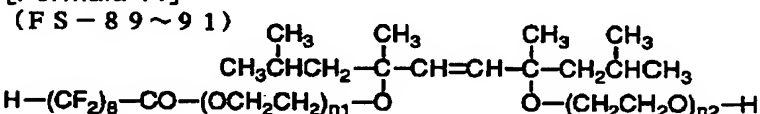
[0051]

[Formula 10]



[0052] FS-86: n₁+n₂=12, FS-87: n₁+n₂=18, FS-88: n₁+n₂=24 [0053]

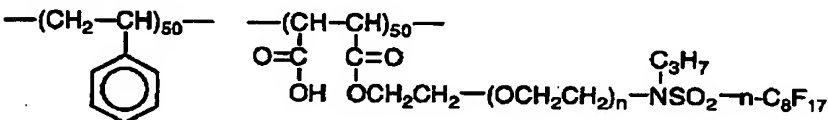
[Formula 11]



[0054] FS-89: n₁+n₂=20, FS-90: n₁+n₂=30, FS-91: n₁+n₂=40 [0055]

[Formula 12]

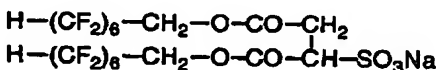
(FS-92~95)



[0056] FS-92: n=5, FS-93: n=10, FS-94: n=15, FS-95: n=20 [0057]

[Formula 13]

(FS-96)

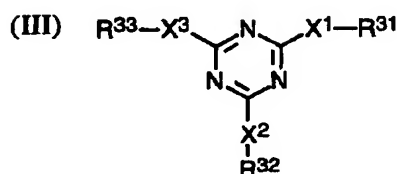


[0058] Two or more kinds of fluorine-containing surfactants may be used together. About a surfactant, various reference (an example, Horiguchi **** "Neogaea side activator" Sankyo Publishing (1975), M.J.Schick, Nonionic Surfactants, Marcell Dekker Inc., New York (1967), JP,7-13293,A) has a publication. It is desirable to use it in 2 thru/or 30% of the weight of the amount of the amount of a disothèque liquid crystallinity molecule, as for a fluorine-containing surface active agent, it is still more desirable to use it in 3 thru/or 25% of the weight of an amount, and its ***** used in 5 thru/or 10% of the weight of an amount is also desirable. The coverage of a fluorine-containing surfactant is 25 thru/or 1000 mg/m². It is desirable that it is the range and they are 30 thru/or 500 mg/m². It is still more desirable that it is the range and they are 35 thru/or 200 mg/m². It is most desirable that it is the range.

[0059] As for the compound which has a 1,3,5-triazine ring, it is desirable that it is the compound expressed with the following type (III).

[0060]

[Formula 14]



[0061] The inside of a formula, X1, and X2 And X3 It is single bond, -NR- (for R, a carbon atomic number is the alkyl group or hydrogen atom of 1 thru/or 30), -O-, or -S-, and, and R31, R32 and R33 are an alkyl group, an alkenyl radical, an aryl group, or a heterocycle radical independently, respectively. As for the compound expressed with a formula (III), it is desirable that it is especially a melamine compound. With a melamine compound, it sets at a ceremony (III), and is X1 and X2. Or X3 It is -NR- or is X1 and X2. Or X3 It is single bond and is the heterocycle radical to which R31, R32, and R33 have a residual valence in a nitrogen atom. A formula (IV) is quoted and a melamine compound is further explained to a detail. - As for R of NR-, it is desirable that it is especially a hydrogen atom. As for R31, R32, and R33, it is desirable that it is especially an aryl group.

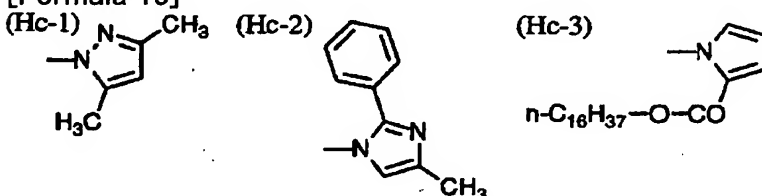
[0062] It is more desirable for the above-mentioned alkyl group to be a chain-like alkyl group from an annular alkyl group. The straight chain-like alkyl group is more desirable than the chain-like alkyl group which has branching. It is more desirable that it is 2 thru/or 30, it is desirable that it is 1 thru/or 30, and it is [as for the carbon atomic number of an alkyl group, it is still more desirable that it is 4 thru/or 30, and] most desirable that it is 6 thru/or 30. The alkyl group may have the substituent. A halogen atom, an alkoxy group (example, methoxy, and ethoxy ** epoxy ethyloxy), and an acyloxy radical (an example, acryloyloxy, methacryloyloxy) are contained in the example of a substituent. It is more desirable for the above-mentioned alkenyl radical to be a chain-like alkenyl radical from an annular alkenyl radical. The straight chain-like alkenyl radical is more desirable than the chain-like alkenyl radical which has branching. It is more desirable that it is 3 thru/or 30, it is desirable that it is 2 thru/or 30, and it is [as for the carbon atomic number of an alkenyl radical, it is still more desirable that it is 4 thru/or 30, and] most desirable that it is 6 thru/or 30. The alkenyl radical may have the substituent. A halogen atom, an alkoxy group (example, methoxy, and ethoxy ** epoxy ethyloxy), and an acyloxy radical (an example, acryloyloxy, methacryloyloxy) are contained in the example of a substituent.

[0063] As for the above-mentioned aryl group, it is desirable that they are phenyl or naphthyl, and it is desirable that it is especially phenyl. The aryl group may have the substituent. For the example of a substituent, a halogen atom, the hydroxyl, cyano ** nitroglycerine, carboxyl, An alkyl group, an alkenyl radical, an aryl group, an alkoxy group, an alkenyloxy radical, An aryloxy group, an acyloxy radical, an alkoxy carbonyl group, an alkenyloxy carbonyl group, An aryloxy carbonyl group, sulfamoyl, an alkylation sulfamoyl group, An alkenyl permutation sulfamoyl group, an aryl permutation sulfamoyl group, A sulfonamide radical, carbamoyl, an alkylation carbamoyl group, an alkenyl permutation carbamoyl group, an aryl permutation carbamoyl group, an amide group, an alkylthio group, an alkenyl thio radical, an arylthio radical, and an acyl group are contained. The above-mentioned alkyl group has the same definition as the alkyl group mentioned above. It is the same as that of an alkoxy group, an acyloxy radical, an alkoxy carbonyl group, an alkylation sulfamoyl group, a sulfonamide radical, an alkylation carbamoyl group, an amide group, an alkylthio group, and the alkyl group that also mentioned the alkyl part of an acyl group above. The above-mentioned alkenyl radical has the same definition as the alkenyl radical mentioned above. It is the same as that of the alkenyl radical which also mentioned above the alkenyl parts of an alkenyloxy radical, an acyloxy radical, an alkenyloxy carbonyl group, an alkenyl permutation sulfamoyl group, a sulfonamide radical, an alkenyl permutation carbamoyl group, an amide group, an alkenyl thio radical, and an acyl group. Phenyl, alpha-naphthyl, beta-naphthyl, 4-methoxyphenyl, 3, 4-diethoxy phenyl, 4-octyloxy phenyl, and 4-dodecyloxy phenyl are contained in the example of the above-mentioned aryl group. The example of the parts of an aryloxy group, an acyloxy radical, an aryloxy carbonyl group, an aryl permutation sulfamoyl group, a sulfonamide radical, an aryl permutation carbamoyl group, an amide group, an arylthio radical, and an acyl group is the same as the example of the above-mentioned aryl group.

[0064] X1 X2 Or X3 As for the heterocycle radical in the case of being -NR-, -O-, or -S-, it is desirable to have aromaticity. Generally the heterocycle which has aromaticity is partial saturation heterocycle, and is heterocycle which has the most desirable double bonds. It is desirable that they are a five-membered ring, six membered-rings, or seven membered-rings, as for heterocycle, it is still more desirable that they are a five-membered ring or six membered-rings, and it is most desirable that they are six membered-rings. As for the hetero atom of heterocycle, it is desirable that they are N, S, or O, and it is desirable that it is especially N. Especially as heterocycle which has aromaticity, a pyridine ring (as a heterocycle radical, they are 2-pyridyl or 4-pyridyl) is desirable. The heterocycle radical may have the substituent. The example of the substituent of a heterocycle radical is the same as the example of the substituent of the above-mentioned aryl part. X1 X2 Or X3 As for the heterocycle radical in the case of being single bond, it is desirable that it is the heterocycle radical which has a residual valence in a nitrogen atom. It is desirable that they are a five-membered ring, six membered-rings, or seven membered-rings, as for the heterocycle radical which has a residual valence in a nitrogen atom, it is still more desirable that they are a five-membered ring or six membered-rings, and it is most desirable that it is a five-membered ring. The heterocycle radical may have two or more nitrogen atoms. Moreover, the heterocycle radical may have hetero atoms other than a nitrogen atom (an example, O, S). The heterocycle radical may have the substituent. The example of the substituent of a heterocycle radical is the same as the example of the substituent of the above-mentioned aryl part. Below, the example of a heterocycle radical with a residual valence in a nitrogen atom.

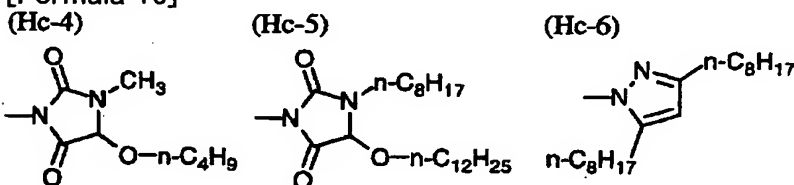
[0065]

[Formula 15]



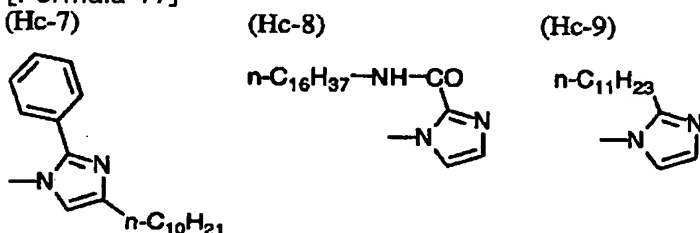
[0066]

[Formula 16]



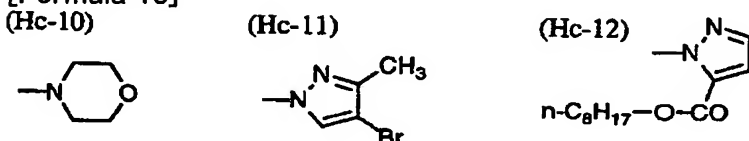
[0067]

[Formula 17]



[0068]

[Formula 18]



[0069] As for at least one of R31, R32, and the R33, it is desirable that a carbon atomic number contains the alkylene parts or alkenylene parts of 9 thru/or 30. As for the alkylene parts or alkenylene parts of 9 thru/or 30, it is desirable that a carbon atomic number is a straight chain-like. As for an alkylene part or an alkenylene part, being contained in the substituent of an aryl group is desirable. Moreover, as for at least one of R31, R32, and the R33, it is desirable to have a polymerization nature machine as a substituent. As for the compound which has a 1,3,5-triazine ring, it is desirable to have at least two polymerization nature machines. Moreover, as for a polymerization nature machine, it is desirable to be located in the end of R31, R32, or R33. It can be made to contain in an optical anisotropy layer in the condition that the compound and discotheque liquid crystallinity molecule which have a 1,3,5-triazine ring are carrying out the polymerization by introducing a polymerization nature machine into the compound which has a 1,3,5-triazine ring. The following type (Rp) shows R31, R32, or R33 which have a polymerization nature machine as a substituent.

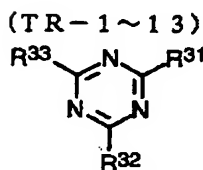
[0070] (Rp) The inside of a $-L5_n(-Q)$ type, and $L5$ It is the connection radical of $** (n+1); Q$ is a polymerization nature machine, and; and n are the integers of 1 thru/or 5. As for the connection radical ($L5$) of $** (n+1)$, in a formula (Rp1), it is desirable that it is the connection radical which combined at least two radicals chosen from the group which consists of an alkylene group, an alkenylene group, an $n+$ univalent aromatic series radical, the heterocycle residue of bivalence, $-CO-$, $-NR-$ (a carbon atomic number is the alkyl group or hydrogen atom of 1 thru/or 30 for R), $-O-$, $-S-$, and $-SO_2-$. As for the carbon atomic number of an alkylene group, it is desirable that it is 1 thru/or 12. As for the carbon atomic number of an alkenylene group, it is desirable that it is 2 thru/or 12. As for the carbon atomic number of an aromatic series radical, it is desirable that it is 6 thru/or 10. $L5$ of a formula (Rp) An example is shown below. Left-hand side is $X1$ of a formula (III), and $X2$. Or it combines with $X3$ (when $X1$, $X2$, or $X3$ is single bond, it links with a 1,3,5-triazine ring directly), and right-hand side combines with a polymerization nature machine ($L53-L59$ n pieces) (Q). In AL, an alkylene group or an alkenylene group, and Hc mean the heterocycle residue of bivalence, and AR means an aromatic series radical. In addition, an alkylene group, an alkenylene group, heterocycle residue, and an aromatic series radical may have the substituent (an example, an alkyl group, halogen atom).

[0071] $L51: -AL-O-CO-L52: -AL-O-L53: -AR(-O-AL-O-CO-) nL54: -AR(-O-AL-O-) nL55: -AR(-O-CO-AL-O-CO-) nL56: -AR(-CO-O-AL-O-CO-) nL57: -AR(-O-CO-AR-O-AL-O-CO-) nL58: -AR(-NR-SO_2-AL-O-CO-) nL59: -AR(-SO_2-NR-AL-O-CO-) n$ [0072] The example of the polymerization nature machine (Q) in a formula (Rp) is the same as the example ($Q1-Q17$) of the polymerization nature machine of a discotheque liquid crystallinity molecule. A polymerization nature machine is used in order to carry out the polymerization of the compound and discotheque liquid crystallinity molecule which have a 1,3,5-triazine ring. Therefore, it is desirable that the polymerization nature machine of a compound and the polymerization nature machine of a discotheque liquid crystallinity molecule which have a 1,3,5-triazine ring are a similar functional group. Therefore, it is desirable that they are a partial saturation polymerization nature machine ($Q1-Q7$), an epoxy group ($Q8$), or an aziridinyl radical ($Q9$), as for the polymerization nature machine of a discotheque liquid crystallinity molecule, and the polymerization nature machine (Q) of the compound which has a 1,3,5-triazine ring similarly, it is still more desirable that it is a partial saturation polymerization nature machine, and it is most desirable that it is an ethylene nature partial saturation polymerization nature machine ($Q1-Q6$). When n is plurality (2 thru/or 5), as for a connection radical ($L5$), it is desirable to branch in an aromatic series radical including an $n+$ univalent aromatic series radical. As for n , it is desirable that it is the integer of 1 thru/or 3.

[0073] The example (except for a melamine compound) of a compound of having a 1,3,5-triazine ring is shown below.

[0074]

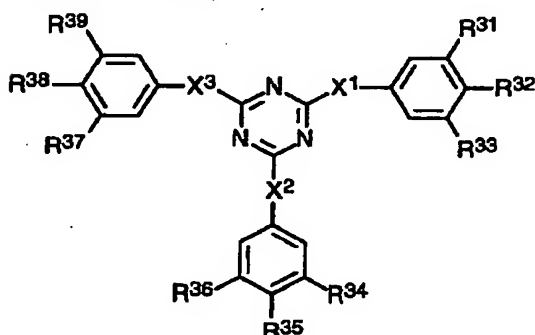
[Formula 19]



[0075] TR-1:R31, R32, R33:-(CH₂)₉-O-CO-CH=CH₂TR-2:R31, R32, R33:-(CH₂)₄-CH=CH-(CH₂)₄-O-CO-CH=CH₂TR-3:R31, and R32:-(CH₂)₉-O-CO-CH=CH₂; R33:-12-CH₃TR-4:R31, R32:-(CH₂)₄-CH=CH-(CH₂)₄-O-CO-CH=CH₂;R33:-(CH₂)₁₂-CH₃TR-5:R31:-(CH₂)₉-O-CO-CH=CH₂;R32, R33:-(CH₂)₁₂-CH₃TR-6:R31:-(CH₂)₄-CH=CH-(CH₂)₄-O-CO-CH=CH₂;R32, R33:-(CH₂)₁₂-CH₃TR-7:R31, and R32:-(CH₂)₄-O-CO-CH=CH₂ (CH₂); R33:-12-CH₃TR-8:R31:-(CH₂)₄-O-CO-CH=CH₂ (CH₂); R32, R33:-12-CH₃TR-9:R31, R32, R33:-(CH₂)₉-O-EpEtTR-10: (CH₂) R31, R32, R33:-4-CH=CH-(CH₂)₄-O-EpEtTR-11:R31, R32:-(CH₂)₉-O-EpEt;R33:-(CH₂)₁₂-CH₃TR-12:R31, R32, R33:-(CH₂)₉-O-CH=CH₂TR-13:R31, R32:-(CH₂)₉-O-CH=CH₂;R33:-(CH₂)₁₂-CH₃(**) EpEt: (CH₂) Epoxy ethyl [0076]

[Formula 20]

(TR-14~65)



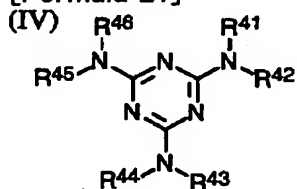
[0077] TR-14: X1, X2, X3:-O-;R32, R35, R38:-O-9-O-CO-CH=CH₂TR-15:X1, X2, X3:-O-;R31, R32, R34, R35 and R37, R38:-O-(CH₂)₉-O-CO-CH=CH₂TR-16:X1, X2, X3:-O-;R32, R35, R38:-O-(CH₂)₄-CH=CH-(CH₂)₄-O-CO-CH=CH₂TR-17: (CH₂) X1, X2, X3:-O-;R31, R32, R34, R35 and R37, R38:-O-(CH₂)₄-CH=CH-(CH₂)₄-O-CO-CH=CH₂TR-18:X1, X2, X3:-O-;R31, R33, R34, R36 and R37, R39:-O-9-O-CO-CH=CH₂TR-19: (CH₂) X1, X2, X3:-O-;R31, R32, R33, R34, R35, R36, R37 and R38, R39:-O-(CH₂)₉-O-CO-CH=CH₂TR-20:X1, X2:-O-;X3:-NH-;R32, R35, R38:-O-9-O-CO-CH=CH₂TR-21: (CH₂) X1, X2:-O-;X3:-NH-;R32, R35:-O-4-O-CO-CH=CH₂;R38:-O-(CH₂)₁₂-CH₃TR-22: (CH₂) X1, X2:-O-;X3:-NH-;R32, R35:-O-4-O-CO-CH=CH₂;R37, R38:-O-(CH₂)₁₂-CH₃TR-23:X1, X2:-O-;X3:-NH-;R32, R35:-O-(CH₂)₄-O-CO-CH=CH₂;R38:-O-CO-(CH₂)₁₁-CH₃TR-24: (CH₂) X1: -O-;X2, X3:-NH-;R31, R33:-O-12-CH₃;R35, R38:-O-(CH₂)₉-O-CO-CH=CH₂TR-25: (CH₂) X1: -O-;X2, X3:-NH-;R31, R32:-O-6-O-CO-CH=CH₂;R35, R38:-O-(CH₂)₁₁-CH₃TR-26:X1:-O-;X2, X3:-NH-;R31, R32, R33:-O-(CH₂)₆-O-CO-CH=CH₂;R35, R38:-O-(CH₂)₁₁-CH₃ [0078] TR-27: X1, X2:-NH-;X3:-S-;R32, R35:-O-(CH₂)₉-O-CO-CH=CH₂;R38:-O-CO-(CH₂)₁₁-CH₃TR-28:X1, X2:-NH-;X3:-S-;R31, R32 and R34, R35:-O-9-O-CO-CH=CH₂;R38:-O-CO-(CH₂)₁₁-CH₃TR-29: (CH₂) X1, X2:-NH-;X3:-S-;R32, R35:-O-4-CH=CH-(CH₂)₄-O-CO-CH=CH₂;R38:-O-CO-(CH₂)₁₁-CH₃TR-30: (CH₂) X1, X2:-NH-;X3:-S-;R31, R32 and R34, R35:-O-4-CH=CH-(CH₂)₄-O-CO-CH=CH₂;R38:-O-CO-(CH₂)₁₁-CH₃TR-31: (CH₂) X1, X2:-NH-;X3:-S-;R31, R33 and R34, R36:-O-9-O-CO-CH=CH₂;R38:-O-CO-(CH₂)₁₁-CH₃TR-32: (CH₂) X1, X2:-NH-;X3:-S-;R31, R32, R33, R34 and R35, R36:-O-(CH₂)₉-O-CO-CH=CH₂;R38:-O-CO-(CH₂)₁₁-CH₃TR-33:X1, X2:-O-;X3:-S-;R32, R35, R38:-O-9-O-CO-CH=CH₂TR-34: (CH₂) X1, X2:-O-;X3:-S-;R32, R35:-O-4-O-CO-CH=CH₂;R38:-O-(CH₂)₁₂-CH₃TR-35:X1, X2:-O-;X3:-S-;R32, R35:-O-(CH₂)₄-O-CO-CH=CH₂;R37, R38:-O-(CH₂)₁₂-CH₃TR-36:X1, X2:-O-;X3:-S-;R32, R35:-O-(CH₂)₄-O-CO-CH=CH₂;R38:-O-CO-(CH₂)₁₁-CH₃TR-37:X1:-O-;X2, X3:-S-;R31, R33:-O-(CH₂)₁₂-CH₃;R35, R38:-O-(CH₂)₉-O-CO-CH=CH₂TR-38:X1:-O-;X2, X3:-S-;R31, R32:-O-(CH₂)₆-O-CO-CH=CH₂;R35, R38:-O-(CH₂)₁₁-CH₃TR-39:X1:-O-;X2, X3:-S-;R31, R32, R33:-O-(CH₂)₆-O-CO-

CH=CH₂;R₃₅, R₃₈: -O- (CH₂) (CH₂) 11-CH₃ [0079] TR-40 : X₁, X₂, X₃: -S-;R₃₂, R₃₅, R₃₈: -O- 9-O-CO-CH=CH₂TR-41:X₁, X₂, X₃: -S-;R₃₁, R₃₂, R₃₄, R₃₅ and R₃₇, R₃₈: -O-(CH₂)9-O-CO-CH=CH₂TR-42:X₁, X₂, X₃: -S-;R₃₂, R₃₅, R₃₈: -O- (CH₂) 4-CH=CH- (CH₂) 4-O-CO-CH=CH₂TR-43 : (CH₂) X₁, X₂, X₃: -S-;R₃₁, R₃₂, R₃₄, R₃₅ and R₃₇, R₃₈: -O-(CH₂)4-CH=CH-(CH₂)4-O-CO-CH=CH₂TR-44:X₁, X₂, X₃: -S-;R₃₁, R₃₃, R₃₄, R₃₆ and R₃₇, R₃₉: -O- 9-O-CO-CH=CH₂TR-45 : (CH₂) X₁, X₂, X₃: -S-;R₃₁, R₃₂, R₃₃, R₃₄, R₃₅, R₃₆, R₃₇ and R₃₈, R₃₉: -O-(CH₂)9-O-CO-CH=CH₂TR-46:X₁, X₂: -S-;X₃: -NH-;R₃₂, R₃₅, R₃₈: -O- 9-O-CO-CH=CH₂TR-47 : (CH₂) X₁, X₂: -S-;X₃: -NH-;R₃₂, R₃₅: -O- (CH₂) 4-O-CO-CH=CH₂;R₃₈: -O-(CH₂)12-CH₃TR-48:X₁, X₂: -S-;X₃: -NH-;R₃₂, R₃₅: -O-(CH₂)4-O-CO-CH=CH₂;R₃₇, R₃₈: -O-(CH₂)12-CH₃ TR-49: X₁, X₂: -S-;X₃: -NH-;R₃₂, R₃₅: -O-(CH₂)4-O-CO-CH=CH₂;R₃₈: -O-CO-(CH₂)11-CH₃TR-50:X₁: -O-;X₂: -NH-;X₃: -S-;R₃₁, R₃₃: -O- 12-CH₃;R₃₅: -O- (CH₂) 9-O-CO-CH=CH₂;R₃₈: -O- (CH₂) 12-CH₃TR-51 : (CH₂) Xone: - O-; X₂: -NH-;X₃: -S-;R₃₁, R₃₂: -O- 6-O-CO-CH=CH₂;R₃₅: -O- (CH₂) 11-CH₃;R₃₈: -O- (CH₂) 12-CH₃TR-52:X₁: -O-;X₂: -NH-;X₃: -S-;R₃₁, R₃₂, R₃₃: -O-(CH₂) <SUB>6-O-CO-CH=CH₂;R₃₅: -O-(CH₂)11-CH₃;R₃₈: -O- (CH₂) (CH₂) 12-CH₃ [0080] TR-53 : X₁, X₂, X₃: -O-;R₃₂, R₃₅, R₃₈: -O- 9-O-EpEtTR-54:X₁, X₂, X₃: -O-;R₃₁, R₃₂, R₃₄, R₃₅ and R₃₇, R₃₈: -O-(CH₂)9-O-EpEtTR-55:X₁, X₂, X₃: -O-;R₃₂, R₃₅, R₃₈: -O- (CH₂) 4-CH=CH- (CH₂) 4-O-EpEtTR-56 : (CH₂) X₁, X₂, X₃: -O-;R₃₁, R₃₂, R₃₄, R₃₅ and R₃₇, R₃₈: -O-(CH₂)4-CH=CH-(CH₂) 4-O-EpEtTR-57:X₁, X₂, X₃: -O-;R₃₁, R₃₃, R₃₄, R₃₆ and R₃₇, R₃₉: -O- 9-O-EpEtTR-58:X₁, X₂, X₃: -O-;R₃₂, R₃₅, R₃₈: -O-(CH₂)9-O-CH=CH₂TR-59:X₁, X₂: -O-;X₃: -NH-;R₃₂, R₃₅, R₃₈: -O-(CH₂) 9-O-EpEtTR-60:X₁, X₂: -O-;X₃: -NH-;R₃₂, R₃₅: -O-(CH₂)4-O-EpEt;R₃₈: -O-(CH₂)12-CH₃TR-61:X₁, X₂: -O-;X₃: -NH-;R₃₂, R₃₅: -O- (CH₂) 4-O-EpEt;R₃₇ and R₃₈: -O- (CH₂) 12-CH₃TR-62:X₁, X₂: -O-;X₃: -NH-;R₃₂, R₃₅: -O-(CH₂)4-O-EpEt;R₃₈: -O-CO-(CH₂)11-CH₃TR-63:X₁: -O-;X₂, X₃: -NH-;R₃₁, R₃₃: -O- (CH₂) 12-CH₃;R₃₅, R₃₈: -O- (CH₂) 9-O-EpEtTR-64 : (CH₂) X₁: -O-;X₂, X₃: -NH-;R₃₁, R₃₂: -O- R without R₃₈[6-O-EpEt;R₃₅, R₃₈: -O-(CH₂)11-CH₃TR-65:X₁, X₂: -O-;X₃: -NH-;R₃₂, R₃₅, and]:-O-(CH₂)9-O-CH=CH₂ (**) definition: (CH₂) Permuting [no] (hydrogen atom).

EpEt: Epoxy ethyl [0081] As for the compound which has a 1,3,5-triazine ring, it is desirable that it is the melamine compound expressed with the following type (IV).

[0082]

[Formula 21]



[0083] The carbon atomic number of R₄₁, R₄₃, and R₄₅ is the alkyl group or hydrogen atom of 1 thru/or 30 independently among a formula, respectively, it is an alkyl group, an alkenyl radical, an aryl group, or a heterocycle radical independently, or R₄₁, R₄₂, R₄₃ and R₄₄, or R₄₅ and R₄₆ join together, and R₄₂, R₄₄, and R₄₆ form heterocycle, respectively. It is desirable that a carbon atomic number is the alkyl group or hydrogen atom of 1 thru/or 20, it is more desirable that a carbon atomic number is the alkyl group or hydrogen atom of 1 thru/or 10, as for R₄₁, R₄₃, and R₄₅, it is still more desirable that a carbon atomic number is the alkyl group or hydrogen atom of 1 thru/or 6, and it is most desirable that it is a hydrogen atom. As for R₄₂, R₄₄, and R₄₆, it is desirable that it is especially an aryl group. A definition and substituent of the above-mentioned alkyl group, an alkenyl radical, an aryl group, and a heterocycle radical are the same as the definition and substituent of each radical which were explained by said formula (III). The heterocycle which R₄₁, R₄₂, R₄₃ and R₄₄, or R₄₅ and R₄₆ combine and form is the same as that of the heterocycle radical which has a residual valence in the nitrogen atom explained by said formula (III).

[0084] As for at least one of R₄₂, R₄₄, and the R₄₆, it is desirable that a carbon atomic number contains the alkylene parts or alkenylene parts of 9 thru/or 30. As for the alkylene parts or alkenylene parts of 9 thru/or 30, it is desirable that a carbon atomic number is a straight chain-

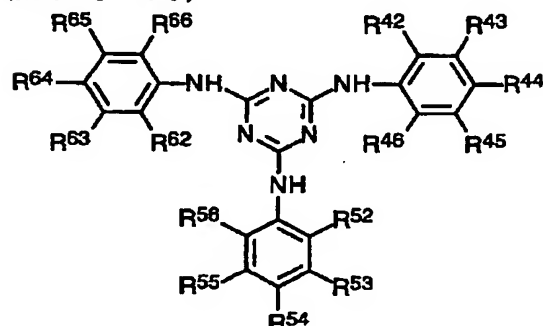
like. As for an alkylene part or an alkenylene part, being contained in the substituent of an aryl group is desirable. Moreover, as for at least one of R42, R44, and the R46, it is desirable to have a polymerization nature machine as a substituent. As for a melamine compound, it is desirable to have at least two polymerization nature machines. Moreover, as for a polymerization nature machine, it is desirable to be located in the end of R42, R44, and R46. It can be made to contain in an optical anisotropy layer in the condition that the melamine compound and the discotheque liquid crystallinity molecule are carrying out the polymerization by introducing a polymerization nature machine into a melamine compound. R42, R44, and R46 which have a polymerization nature machine as a substituent are the same as that of the radical shown by the formula (Rp) mentioned above.

[0085] The example of a melamine compound is shown below.

[0086]

[Formula 22]

(MM-1 ~ 46)



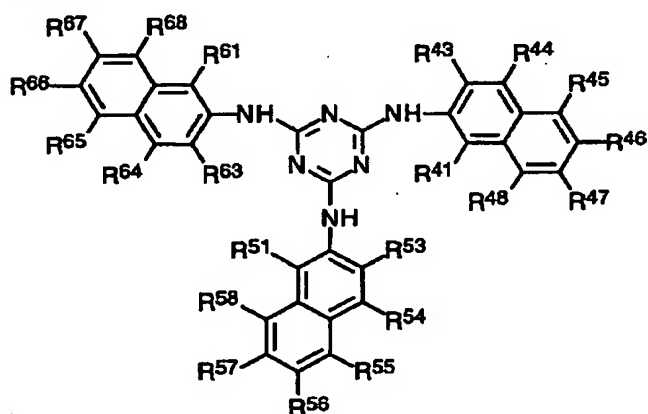
[0087] MM-1: R43, R44, R53, R54 and R63, R64:-O-(CH₂)₉-CH₃MM-2:R43, R44, R53, R54 and R63, R64:-O-(CH₂)₁₁-CH₃MM-3:R43, R44, R53, R54 and R63, R64:-O-15-CH₃MM-4:R44, R54, R64:-O-(CH₂)₉-CH₃MM-5:R44, R54, R64:-O-(CH₂)₁₅-CH₃MM-6:R43, R53, R63:-O-CH₃;R44, R54, R64:-O-(CH₂)₁₇-CH₃MM-7:R44, R54, R64:-CO-O-(CH₂)₁₁-CH₃MM-8:R44, R54, R64:-SO₂-NH-(CH₂)₁₇-CH₃MM-9:R43, R53, R63:-O-CO-(CH₂)₁₅-CH₃MM-10:(CH₂)₄, R42, R52, R62:-O-17-CH₃MM-11:R42, R52, R62:-O-CH₃;R43, R53, R63:-CO-O-(CH₂)₁₁-CH₃MM-12:R42, R52, R62:-Cl;R43, R53, R63:-CO-O-(CH₂)₁₁-CH₃MM-13:R42, R52, R62:-O-(CH₂)₁₁-CH₃;R45, R55, R65:-SO₂-NH-iso-C₃H₇[0088] MM-14: R42, R52, R62:-Cl;R45, R55, R65:-SO₂-NH-(CH₂)₁₅-CH₃MM-15:R42, R46, R52, R56 and R62, R66:-Cl;R45, R55, R65:-SO₂-NH-19-CH₃MM-16:R43, R54:-O-(CH₂)₉-CH₃; (CH₂)₄, R44, R53, R63, R64:-O-11-CH₃MM-17:R44:-O-(CH₂)₁₁-CH₃;R54:-O-(CH₂)₁₅-CH₃;R64:-O-(CH₂)₁₇-CH₃MM-18:R42, R45, R52, R55 and R62, R65:-O-CH₃;R44, R54, R64:-NH-CO-(CH₂)₁₄-CH₃MM-19:R42, R45, R52, R55 and R62, R65:-O-(CH₂)₃-CH₃;R44, R54, R64:-O-(CH₂)₁₅-CH₃MM-20:(CH₂)₄, R42, R52, R62:-NH-SO₂-15-CH₃; (CH₂)₄, R44, R45, R54, R55, R64, R65:-C₁₀H₇MM-21:R42, R43, R52, R53, R62, R63:-F;R44, R54, R64:-CO-NH-15-CH₃; (CH₂)₄, R45, R46, R55, R56, R65, R66:-C₁₀H₇MM-22:R42, R52, R62:-Cl;R44, R54, R64:-CH₃;R45, R55, R65:-NH-CO-(CH₂)₁₂-CH₃MM-23:R42, R52, R62:-OH;R44, R54, R64:-CH₃;R45, R55, R65:-O-15-CH₃MM-24:R42, R45, R52, R55 and R62, R65:-O-CH₃;R44, R54, R64:-O-(CH₂)₁₁-CH₃MM-25:R42, R52, R62:-NH-SO₂-CH₃;R45, R55, R65:-CO-O-(CH₂)₁₁-CH₃MM-26:R42, R52, R62:-S-(CH₂)₁₁-CH₃;R45, R55, R65:-SO₂-NH₂ [0089] MM-27:R43, R44, R53, R54, R63, R64:-O-12-O-CO-CH=CH₂MM-28:R43, R44, R53, R54 and R63, R64:-O-(CH₂)₈-O-CO-CH=CH₂MM-29:R43, R44, R53, R54 and R63, R64:-O-CO-(CH₂)₇-O-CO-CH=CH₂MM-30:R44, R54, R64:-CO-O-(CH₂)₁₂-O-CO-C(CH₃)=CH₂MM-31:R43, R44, R53, R54 and R63, R64</SUP>:-O-CO-p-Ph-O-(CH₂)₄-O-CO-CH=CH₂MM-32:(CH₂)₄, R42, R44, R52, R54, R62, R64:-NH-SO₂-(CH₂)₈-O-CO-CH=CH₂;R45, R55, R65:-C₁₀H₇MM-33:R42, R52, R62:-NH-SO₂-CH₃;R45, R55, R65:-CO-O-(CH₂)₁₂-O-CO-CH=CH₂ [0090] MM-34:R44, R54, R64:-O-9-O-CO-CH=CH₂MM-35:R43, R44, R53, R54 and R63, R64:-O-(CH₂)₉-O-CO-CH=CH₂MM-36:R44, R54, and R64:-O-(CH₂)₄-CH=CH-(CH₂)₄-O-CO-CH=CH₂MM-37:R43, R44, R53, R54 and R63, R64:-O-(CH₂)₄-CH=CH-(CH₂)₄-O-CO-CH=CH₂MM-38:R43, R45, R53, R55 and R63, R65:-O-(CH₂)₉-O-CO-CH=CH₂MM-39:(CH₂)₄, R43, R44, R45, R53, R54, R55,

R63, R64, R65: -O- 9-O-CO-CH=CH₂MM-40 : (CH₂) R44, R54: -O- 4-O-CO-CH=CH₂; R64: -O- (CH₂) 9-O-CO-CH=CH₂MM-41: R44, R54: -O- (CH₂) 4-O-CO-CH=CH₂; R64: -O- (CH₂) 12-CH₃MM-42: R44, R54: -O- (CH₂) 4-O-CO-CH=CH₂; R63, R64: -O- (CH₂) 12-CH₃MM-43: R44, R54: -O- (CH₂) 4-O-CO-CH=CH₂; R63, R64: -O-CO- (CH₂) 11-CH₃MM-44: R43, R45: -O- (CH₂) 12-CH₃; R54, R64: -O- (CH₂) 9-O-CO-CH=CH₂MM-45: R43, R44: -O- (CH₂) (CH₂) 6-O-CO-CH=CH₂; R54, R64: -O- (CH₂) 11-CH₃MM-46: R43, R44, R45: -O- (CH₂) 6-O-CO-CH=CH₂; R54, R64: -O- (CH₂) 11-CH₃ R without a definition: (**) Permuting [no] (hydrogen atom).

p-Ph: p-phenylene [0091]

[Formula 23]

(MM- 4 7 ~ 5 9)

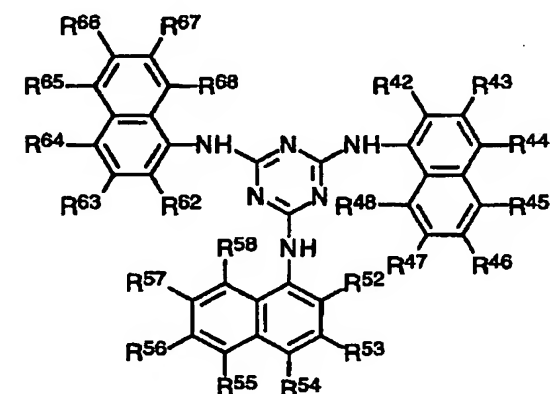


[0092] MM-47: R46, R56, R66: -SO₂-NH- 15-CH₃; R48, R58, R68: -O- (CH₂) 11-CH₃MM-48: R45, R55, R65: -SO₂-NH- (CH₂) 17-CH₃MM-49: R46, R56, R66: -SO₂-NH- (CH₂) 15-CH₃MM-50: R45, R55, R65: -O- (CH₂) 17-CH₃; (CH₂) R47, R57, R67: -SO₂-NH-CH₃MM-51: R43, R53, R63: -O- (CH₂) 15-CH₃MM-52: R41, R51, R61: -O- (CH₂) 17-CH₃MM-53: R46, R56, R66: -SO₂-NH-Ph; R48, R58, R68: -O- 11-CH₃MM-54 : (CH₂) R45, R55, R65: -O- 21-CH₃; R47, R57, R67: -SO₂-NH-PhMM-55: R41, R51, R61: -p-Ph- (CH₂) 11-CH₃MM-56: R46, R48, R56, R58 and R66, R68: -SO₂-NH- (CH₂) 7-CH₃MM-57: R46, R56, R66: -SO₂-NH- (CH₂) 10-O-CO-CH=CH₂; R48, R58, R68: -O- (CH₂) 12-CH₃MM-58: R45, R55, R65: -O- (CH₂) R without R63 [12-O-CO-CH=CH₂; R47, R57, R67: -SO₂-NH-PhMM-59: R43, R53, and]: -O- (CH₂) 16-O-CO-CH=CH₂ (**) definition: (CH₂) Permuting [no] (hydrogen atom).

Ph: Phenyl p-Ph: p-phenylene [0093]

[Formula 24]

(MM- 6 0 ~ 7 1)



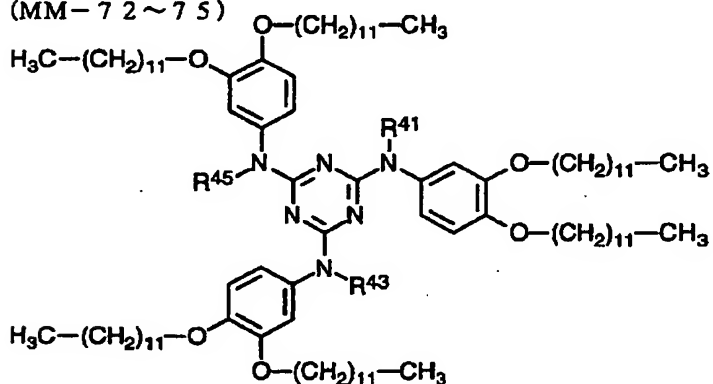
[0094] MM-60: R45, R55, R65: -NH-CO- 14-CH₃MM-61: R42, R52, R62: -O- (CH₂) 17-CH₃MM-62: R44, R54, R64: -O- (CH₂) 15-CH₃MM-63: R45, R55, R65: -SO₂-NH- (CH₂) 15-CH₃MM-64: R43, R53, R63: -CO-NH- (CH₂) 17-CH₃; R44, R54, R64: -OHMM-65: R45, R55, R65: -O- (CH₂) 15-CH₃; R46, R56, R66: -SO₂-NH- (CH₂) 11-CH₃MM-66: R47, R57, R67: -O- (CH₂) 21-CH₃MM-67: R44, R54, R64: -O-p-Ph- (CH₂) 11-CH₃MM-68: R46, R56, R66: -SO₂-NH- (CH₂) 15-CH₃MM-

69:R43, R53, R63:-CO-NH-(CH₂)₁₇-CH₃;R44, R54, R64:-O-(CH₂)₁₂-O-CO-CH=CH₂MM-
 70:R45, R55, R65:-O-(CH₂)₈-O-CO-CH=CH₂;R46, R56, R66:-SO₂-NH-(CH₂)₁₁-CH₃MM-
 71:R43, R46, R53, R56 and R63, R66:-SO₂-NH-(CH₂)₈-O-CO-CH=CH₂ (CH₂) R without a
 definition: (**) Permuting [no] (hydrogen atom).

p-Ph:p-phenylene [0095]

[Formula 25]

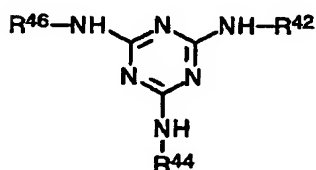
(MM-72~75)



[0096] MM-72: R41, R43, R45:-CH₃MM-73:R41, R43, R45:-C₂H₅MM-74:R41, R43:-C₂H₅;R45:-
 CH₃MM-75:R41, R43, R45:- (CH₂)₃-CH₃ [0097]

[Formula 26]

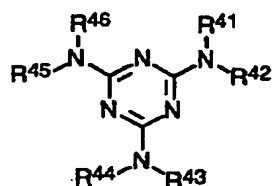
(MM-76~88)



[0098] MM-76: R42, R44, R46:- 9-O-CO-CH=CH₂MM-77:R42, R44, R46:- (CH₂)₄-CH=CH-(CH₂)
 4-O-CO-CH=CH₂MM-78:R42, and R44:- (CH₂)₉-O-CO-CH=CH₂ (CH₂) ; R46:- 12-CH₃MM-
 79:R42, R44:- (CH₂)₄-CH=CH-(CH₂)₄-O-CO-CH=CH₂;R46:- (CH₂)₁₂-CH₃MM-80:R42:-
 (CH₂)₉-O-CO-CH=CH₂;R44, R46:- (CH₂)₁₂-CH₃MM-81:R42:- (CH₂)₄-CH=CH-(CH₂)₄-O-CO-
 CH=CH₂;R44, R46:- (CH₂)₁₂-CH₃MM-82:R42, and R44:- (CH₂)₄-O-CO-CH=CH₂ (CH₂) ; R46:-
 12-CH₃MM-83:R42:- (CH₂)₄-O-CO-CH=CH₂ (CH₂) ; R44, R46:- 12-CH₃MM-84:R42, R44,
 R46:- (CH₂)₉-O-EpEtMM-85:R42, R44, R46:- (CH₂)₄-CH=CH-(CH₂)₄-O-EpEtMM-86:R42, R44:-
 (CH₂)₉-O-EpEt;R46:- (CH₂)₁₂-CH₃MM-87:R42, R44, R46:- (CH₂)₉-O-CH=CH₂MM-88:R42,
 R44:- (CH₂)₉-O-CH=CH₂;R46:- (CH₂)₁₂-CH₃(**) EpEt: (CH₂) Epoxy ethyl [0099]

[Formula 27]

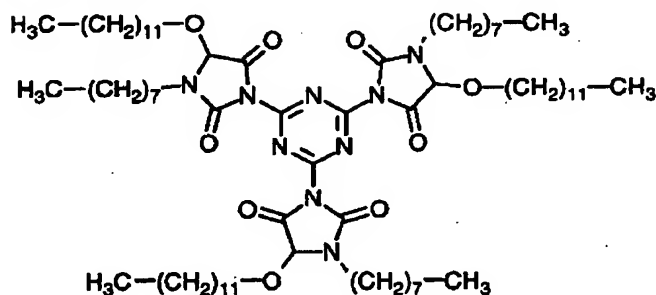
(MM-89~95)



[0100] MM-89: R41, R42, R43, R44 and R45, R46:- (CH₂)₉-CH₃MM-90:R41, R43, R45:-CH₃;R42,
 R44, R46:- (CH₂)₁₇-CH₃MM-91:R41, R42 and R43, R44:- 7-CH₃;R45, R46:- (CH₂)₅-CH₃MM-
 92 : (CH₂) R41, R42, R43, R44, R45, R46:-CyHxMM-93:R41, R42, R43, R44 and R45, R46:- (CH₂)
 2-O-C₂H₅MM-94:R41, R43, R45:-CH₃;R42, R44, R46:- 12-O-CO-CH=CH₂MM-95:R41, R42,
 R43, R44 and R45, R46:- (CH₂)₈-O-CO-CH=CH₂(**) CyHx: (CH₂) Cyclohexyl [0101]

[Formula 28]

(MM-96)

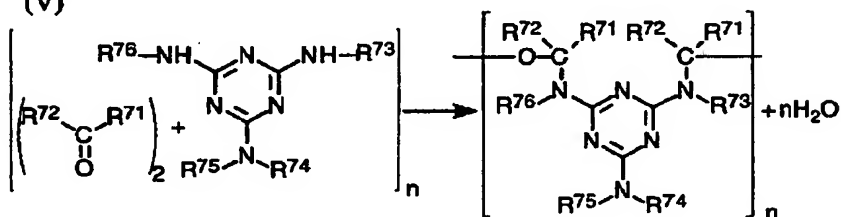


[0102] A melamine polymer may be used as a melamine compound. As for a melamine polymer, it is desirable to compound by the polymerization reaction of the melamine compound and carbonyl compound which are shown by the following formula (V).

[0103]

[Formula 29]

(V)



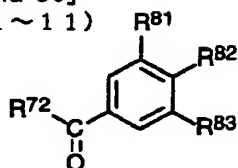
[0104] R71, R72, R73, R74, R75, and R76 are a hydrogen atom, an alkyl group, an alkenyl radical, an aryl group, or a heterocycle radical independently among a formula, respectively. A definition and substituent of the above-mentioned alkyl group, an alkenyl radical, an aryl group, and a heterocycle radical are the same as the definition and substituent of each radical which were explained by said formula (III). The polymerization reaction of a melamine compound and a carbonyl compound is the same as that of the synthetic approach of usual melamine resin (an example, melamine formaldehyde resin). A commercial melamine polymer (melamine resin) may be used. As for the molecular weight of a melamine polymer, it is desirable that it is [or more 2000] 400,000 or less.

[0105] As for at least one of R71, R72, R73, R74, R75, and the R76, it is desirable that a carbon atomic number contains the alkylene parts or alkenylene parts of 9 thru/or 30. As for the alkylene parts or alkenylene parts of 9 thru/or 30, it is desirable that a carbon atomic number is a straight chain-like. As for an alkylene part or an alkenylene part, being contained in the substituent of an aryl group is desirable. Moreover, as for at least one of R71, R72, R73, R74, R75, and the R76, it is desirable to have a polymerization nature machine as a substituent. Moreover, as for a polymerization nature machine, it is desirable to be located in the end of R71, R72, R73, R74, R75, and R76. It can be made to contain in an optical anisotropy layer in the condition that the melamine polymer and the discotheque liquid crystallinity molecule are carrying out the polymerization by introducing a polymerization nature machine into a melamine polymer. R71, R72, R73, R74, R75, and R76 which have a polymerization nature machine as a substituent are the same as that of the radical shown by the formula (Rp) mentioned above. What is necessary is just to introduce a polymerization nature machine into one side of a carbonyl compound (R71, R72) and a melamine compound (R73, R74, R75, R76). When a melamine compound has a polymerization nature machine, the compound of the easy chemical structure [like formaldehyde] whose carbonyl compound is is used preferably. When a carbonyl compound has a polymerization nature machine, the compound of the easy chemical structure [like a melamine (permuting / no /)] whose melamine compound is is used preferably.

[0106] The example of the carbonyl compound which has a polymerization nature machine is shown below.

[0107]

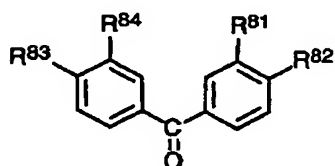
[Formula 30]
(CO-1 ~ 11)



[0108] CO-1: R72:-H;R82:-O-9-O-CO-CH=CH2CO-2:(CH2)R72:-H;R81 and R82:-O-9-O-CO-CH=CH2CO-3:R72:-H;R82:-O-(CH2)4-CH=CH-(CH2)4-O-CO-CH=CH2CO-4:R72:-H;R81 and R82:-O-(CH2)4-CH=CH-(CH2)4-O-CO-CH=CH2CO-5:(CH2)R72:-H;R81 and R83:-O-9-O-CO-CH=CH2CO-6:R72:-H;R81, R82, R83:-O-(CH2)9-O-CO-CH=CH2CO-7:R72:-CH3;R82:-O-(CH2)9-O-CO-CH=CH2CO-8:R72:-O-(CH2)11-CH3;R82:-O-(CH2)4-O-CO-CH=CH2CO-9:R72:-O-(CH2)9-O-CO-CH=CH2;R82:-O-(CH2)4-O-CO-CH=CH2CO-10:R72:-O-(CH2)R without R83[9-O-CO-EpEt;R82:-O-(CH2)4-O-CO-CH=CH2CO-11:R72:-O-(CH2)4-O-CO-CH=CH2;R81 and]:-O-(CH2)12-CH3(**) definition: (CH2) Permuting [no] (hydrogen atom).

EpEt: Epoxy ethyl [0109]

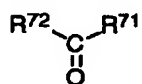
[Formula 31]
(CO-12 ~ 13)



[0110] CO-12: R without R83[R81, R82 and R83, R84:-O-(CH2)6-O-CO-CH=CH2CO-13:R82, and]:-O-(CH2)9-O-CO-CH=CH2(**) definition: Permuting [no] (hydrogen atom).

[0111]

[Formula 32]
(CO-14 ~ 26)

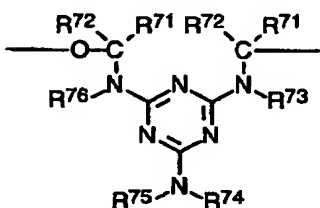


[0112] CO-14:R71:-O-(CH2)9-O-CO-CH=CH2; R72:-HCO-15:R71:-O-(CH2)4-CH=CH-(CH2)4-O-CO-CH=CH2; R72:-HCO-16:R71:-O-(CH2)9-O-CO-CH=CH2; R72:-CH3CO-17:R71:-O-(CH2)4-CH=CH-(CH2)4-O-CO-CH=CH2; R72:-CH3CO-18:R71:-O-(CH2)9-O-CO-CH=CH2;R72:-PhCO-19:R71:-O-(CH2)4-CH=CH-(CH2)4-O-CO-CH=CH2;R72:-PhCO-20:R71:-O-(CH2)4-O-CO-CH=CH2;R72:-O-9-O-CO-CH=CH2CO-21:R71:-O-(CH2)4-O-CO-CH=CH2;R72:-O-(CH2)12-CH3CO-22:R71:-O-(CH2)9-O-EpEt;R72:-HCO-23:R71:-O-(CH2)4-CH=CH-(CH2)4-O-EpEt;R72:-HCO-24:R71, R72:-O-(CH2)9-O-EpEtCO-25:R71, R72:-O-(CH2)9-O-CO-CH=CH2CO-26:R71, R72:-O-(CH2)4-CH=CH-(CH2)4-O-CO-CH=CH2(**) Ph:phenyl EpEt: (CH2) Epoxy ethyl [0113]

The example of the melamine polymer which has a polymerization nature machine in a melamine compound side is shown below.

[0114]

[Formula 33]
(MP-1 ~ 14)



[0115] MP-1: R73, R75, R76:-CH₂-NH-CO-CH=CH₂;R74:-CH₂-NH-CO-(CH₂)₈-CH₃MP-2:R71:-CH₃;R73, R75, R76:-CH₂-NH-CO-CH=CH₂;R74:-CH₂-NH-CO- 8-CH₃MP-3 : (CH₂) R71, R72: - CH₃;R73, R75, R76:-CH₂-NH-CO-CH=CH₂;R74:-CH₂-NH-CO-(CH₂)₈-CH₃MP-4:R71 :- P h;R73, R75, R76:-CH₂-NH-CO-CH=CH₂;R74:-CH₂-NH-CO- 8-CH₃MP-5 : (CH₂) R73, R76: - CH₂-NH-CO-CH=CH₂;R74:-CH₂-NH-CO-(CH₂)₇-CH=CH-(CH₂)₇-CH₃;R75:-CH₂-O-CH₃MP-6:R73, R76:-CH₂-NH-CO-CH=CH₂;R74:-CH₂-NH-CO- 7-CH=CH- (CH₂) 7-CH₃; (CH₂) R75: - CH₂-OHMP-7 : R73, R76:-CH₂-NH-CO-C₂H₅;R74:-CH₂-NH-CO-(CH₂)₁₆-CH₃;R75:-CH₂-O-CH₃MP-8:R73, R76:-CH₂-NH-CO-C₂H₅;R74:-CH₂-NH-CO- 16-CH₃; (CH₂) R75: - CH₂-OHMP-9 : R73, R76: - CH₂-O-CO-CH=CH₂;R74:-CH₂-O-CO-(CH₂)₇-CH=CH-(CH₂)₇-CH₃;R75:-CH₂-O-CH₃MP-10:R73, R76:-CH₂-O-CO-CH=CH₂;R74:-CH₂-O-CO- 7-CH=CH-(CH₂) 7-CH₃; (CH₂) R75: - CH₂-OHMP-11 : R73, R76:-CH₂-O-CO- 7-CH=CH- (CH₂) 7-CH₃;R74:-CH₂-NH-CO- (CH₂) 7-CH=CH- (CH₂) 7-CH₃;R75:-CH₂-O-CH₃MP-12:R73, R76:-CH₂-O-CO-(CH₂)₇-CH=CH-(CH₂)₇-CH₃;R74:-CH₂-NH-CO-(CH₂)₇-CH=CH- (CH₂) 7-CH₃;R75:-CH₂-OHMP-13:R73, R74 and R75, R76:-CH₂-O-(CH₂)₁₁-O-CO-CH=CH₂MP-14:R73, R75, R76:-CH₂-NH-CO-CH=CH₂;R74:-CH₂-O- (CH₂) R without 16-CH₃ (**) definition: (CH₂) Permuting [no] (hydrogen atom).

Ph: Phenyl [0116] The compound (a melamine compound and a melamine polymer are included) which has two or more kinds of 1,3,5-triazine rings may be used together. It is desirable to use it in 0.01 thru/or 20% of the weight of the amount of the amount of a discotheque liquid crystallinity molecule, as for the compound which has a 1,3,5-triazine ring, it is still more desirable to use it in 0.1 thru/or 15% of the weight of an amount, and it is most desirable to use it in 0.5 thru/or 10% of the weight of an amount. The coverage of a compound which has a 1,3,5-triazine ring is 1 thru/or 1000 mg/m². It is desirable that it is the range and they are 2 thru/or 300 mg/m². It is still more desirable that it is the range and they are 3 thru/or 100 mg/m². It is most desirable that it is the range.

[0117] An optical anisotropy layer forms the liquid crystal constituent (coating liquid) containing a discotheque liquid crystallinity molecule or the following polymerization nature initiator, or the additive (an example, a plasticizer, a monomer, a surface active agent, cellulose ester, a 1,3,5-triazine compound, chiral agent) of arbitration by applying on the orientation film. As a solvent used for preparation of a liquid crystal constituent, an organic solvent is used preferably. An amide (an example, N,N-dimethylformamide), a sulfoxide (an example, dimethyl sulfoxide), a heterocycle compound (an example, pyridine), a hydrocarbon (an example, benzene, hexane), alkyl halide (an example, chloroform, dichloromethane), ester (an example, methyl acetate, butyl acetate), a ketone (an example, an acetone, methyl ethyl ketone), and the ether (an example, a tetrahydrofuran, 1, 2-dimethoxyethane) are contained in the example of an organic solvent. Alkyl halide and a ketone are desirable. Two or more kinds of organic solvents may be used together. Spreading of a liquid crystal constituent can be carried out by the well-known approach (an example, a wire bar coating method, an extrusion coating method, the direct gravure coating method, the reverse gravure coating method, die coating method).

[0118] The thermal polymerization reaction which uses a thermal polymerization initiator, and the photopolymerization reaction using a photopolymerization initiator are included in the polymerization reaction of a discotheque liquid crystallinity molecule. A photopolymerization reaction is desirable. the example of a photopolymerization initiator — alpha-carbonyl compound (a U.S. Pat. No. 2367661 number —) Each specification publication of said 2367670 numbers, the acyloin ether (U.S. Pat. No. 2448828 number specification publication), alpha-hydrocarbon permutation aromatic series acyloin compound (U.S. Pat. No. 2722512 number specification publication), a polykaryotic quinone compound (a U.S. Pat. No. 3046127 number — said — each specification publication of No. 2951758) — The combination of a thoria reel imidazole dimer and p-aminophenyl ketone (U.S. Pat. No. 3549367 number specification publication), An acridine, a phenazine compound (JP,60-105667,A, U.S. Pat. No. 4239850 number specification publication), and an oxadiazole compound (U.S. Pat. No. 4212970 number specification publication) are contained. As for the amount of the photopolymerization initiator used, it is desirable that they are 0.01 of the solid content of coating liquid thru/or 20 % of the weight, and it is still more desirable that they are 0.5 thru/or 5 % of the weight. As for the optical exposure for the

polymerization of a discotheque liquid crystallinity molecule, it is desirable to use ultraviolet rays. exposure energy -- 20 mJ/cm² Or 50 J/cm² it is -- things -- desirable -- 100 thru/or 800 mJ/cm² it is -- things are still more desirable. In order to promote a photopolymerization reaction, an optical exposure may be carried out under heating conditions. It is desirable that they are 0.1 thru/or 20 micrometers, as for the thickness of an optical anisotropy layer, it is still more desirable that they are 0.5 thru/or 15 micrometers, and it is most desirable that they are 1 thru/or 10 micrometers.

[0119] There are iodine system polarization film, and the color system polarization film and polyene system polarization film which use dichromatic dye as [polarization film] polarization film. Generally the iodine system polarization film and the color system polarization film are manufactured using a polyvinyl alcohol system film. The polarization shaft of the polarization film corresponds in the direction perpendicular to the extension direction of a film. As for the transparency shaft within the field of the polarization film, it is desirable to arrange so that it is parallel or may intersect perpendicularly with the lagging axis of a transprence base material substantially.

[0120] A transparent polymer film is used as a [transprence protective coat] transprence protective coat. It means that light transmittance is 80% or more as a protective coat is transparent. as a transprence protective coat -- general -- a cellulose ester film -- a triacetyl cellulose film is used preferably. As for a cellulose ester film, forming by the solvent cast method is desirable. As for the thickness of a transprence protective coat, it is desirable that they are 20 thru/or 500 micrometers, and it is still more desirable that they are 50 thru/or 200 micrometers.

[0121] [Liquid crystal display] this invention is applicable to the liquid crystal cell of various display modes. As mentioned above, the optical compensation sheet using a liquid crystallinity molecule TN (Twisted Nematic), IPS (In-Plane Switching), FLC (Ferroelectric Liquid Crystal), OCB (OpticallyCompensatory Bend), STN (Supper Twisted Nematic), VA (VerticallyAligned), The thing corresponding to the liquid crystal cell in ECB (Electrically Controlled Birefringence) and HAN (Hybrid Aligned Nematic) mode is already proposed. This invention is effective in the liquid crystal display using a liquid crystal cell like VA mode with many cylindrical liquid crystallinity molecules which are carrying out orientation perpendicularly substantially, OCB mode, and HAN mode, and effective especially in the liquid crystal display in VA mode in which most cylindrical liquid crystallinity molecules are carrying out orientation perpendicularly substantially.

Orientation of the (1) cylindrical liquid crystallinity molecule is substantially carried out to the liquid crystal cell in VA mode perpendicularly at the time of no electrical-potential-difference impressing. To the liquid crystal cell (JP,2-176625,A publication) in VA mode of the narrow sense which carries out orientation horizontally substantially at the time of electrical-potential-difference impression, in addition, a (2) angle-of-visibility expansion sake, The liquid crystal cell which formed VA mode into the multi-domain (MVA mode) (SID97, Digest of tech.Papers (collection of drafts)28 (1997) 845 publication), (3) Perpendicular orientation of the cylindrical liquid crystallinity molecule is substantially carried out at the time of no electrical-potential-difference impressing. The liquid crystal cell (58 to collection of drafts 59 (1998) publication of a Japanese liquid crystal debate) in the mode (n-ASM mode) which can twist at the time of electrical-potential-difference impression, and carries out multi-domain orientation, and the liquid crystal cell (LCD International 98 announces) in (4) SURVAIVAL mode are contained.

[0122]

[Example] [Example 1]

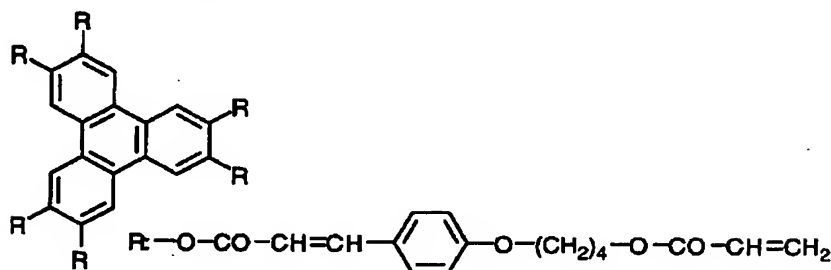
(Production of an optical compensation sheet) Cellulose diacetate was applied, it dried to one field of a cellulose triacetate film, and the under coat (orientation film which has not carried out rubbing processing) whose desiccation thickness is 0.5 micrometers was formed in it. The following discotheque liquid crystallinity molecule (1) 90 weight section, the ethyleneoxide denaturation trimethylolpropane triacrylate (V#360, product made from Osaka Organic chemistry) 10 weight section, melamine formaldehyde / acrylic-acid copolymer (Aldrich reagent) 0.6 weight section, the photopolymerization initiator (IRGACURE 907, Ciba-Geigy Japan make) 3.0 weight section, and the photosensitizer (kaya KYUA DETX, Nippon Kayaku Co., Ltd. make) 1.0 weight

section were dissolved in the methyl ethyl ketone, and the coating liquid whose solid content concentration is 38 % of the weight was prepared.

[0123]

[Formula 34]

ディスコティック液晶性化合物 (1)



[0124] Coating liquid was applied on the under coat and it dried. It heated for 2 minutes at 130 degrees C, and orientation of the discotheque liquid crystallinity molecule was carried out. It cooled to the room temperature immediately, the ultraviolet rays of 500 mJ/cm² were irradiated, the polymerization of the discotheque liquid crystallinity molecule was carried out, and the orientation condition was fixed. The thickness of the formed optical anisotropy layer was 1.7 micrometers. The angular dependence of the retardation of an optical anisotropy layer was measured by the ellipsometer (Jasco Corp. make). Consequently, the retardation (R_{th}) of 0.2 degrees and the thickness direction of the average tilt angle of a discotheque liquid crystallinity molecule was 88nm.

[0125] The binder was used for the field of another side of a cellulose triacetate film, the polycarbonate film which has optical optically uniaxial was stuck, and the optical compensation sheet was produced. The polycarbonate film which has optical optically uniaxial has an optical axis in a field, and the retardation within a field (R_e) is a retardation of 50nm and the thickness direction. It was nm. The retardation (R_{th}) of 50nm and the thickness direction of the retardation within a field of the produced whole optical compensation sheet (R_e) was 100nm.

[0126] (Production of a elliptically-polarized-light plate) To the transparence base material (polycarbonate film) side of an optical compensation sheet, the laminating of the polarization film and the transparence protective coat was carried out to this order, and the elliptically-polarized-light plate was produced. The lagging axis of a transparence base material and the polarization shaft of the polarization film have been arranged so that it may become parallel.

[0127] (Production of a liquid crystal display) The elliptically-polarized-light plate was deleted from commercial VA liquid crystal display (LCD5000), and the elliptically-polarized-light plate produced instead was stuck. When the contrast data of an omnidirection were measured about produced VA liquid crystal display, the angle of visibility from which a contrast ratio 20:1 is obtained was 160 degrees of four directions. On the other hand, in commercial VA liquid crystal display (LCD5000), the angle of visibility from which a contrast ratio 20:1 is obtained was 120 degrees of four directions.

[0128] [Example 2]

(Production of an optical optically biaxial transparence base material) The cellulose triacetate 87 weight section, the triphenyl phosphate 10 weight section, and the ultraviolet ray absorbent (TM165, Sumitomo Chemical Co., Ltd. make) 3 weight section were dissolved in the methylene chloride, and the solution whose solid content concentration is 18 % of the weight was prepared. The solution was cast on the glass plate and it dried for 20 minutes at 40 degrees C. The formed film (thickness: 100 micrometers) was exfoliated from the glass plate. To the produced cellulose triacetate film, it is 2 20kg/mm for 10 minutes at 145 degrees C. Stress was applied. Thus, the retardation within a field (R_e) produced the optical optically biaxial transparence base material whose retardation (R_{th}) of 20nm and the thickness direction is 80nm.

[0129] (Production of an optical compensation sheet) It is coating liquid of an optical anisotropy layer used in the example 1 on an optical optically biaxial transparence base material 3 ml/m² It

applied and dried at the room temperature. It heats for 1 minute at 130 degrees C, and orientation of the discotheque liquid crystallinity molecule was carried out, ultraviolet rays were irradiated, the polymerization of the discotheque liquid crystallinity molecule was carried out, and the orientation condition was fixed. The angular dependence of the retardation of an optical anisotropy layer was measured by the ellipsometer (Jasco Corp. make). Consequently, the average tilt angle of a discotheque liquid crystallinity molecule was 0.1 degrees. The retardation (R_{th}) of 20nm and the thickness direction of the retardation within a field of the produced whole optical compensation sheet (R_e) was 140nm.

[0130] (Production of a elliptically-polarized-light plate) To the transparence base material side of an optical compensation sheet, the laminating of the polarization film and the transparence protective coat was carried out to this order, and the elliptically-polarized-light plate was produced. The lagging axis of a transparence base material and the polarization shaft of the polarization film have been arranged so that it may become parallel.

[0131] (Production of a liquid crystal display) The elliptically-polarized-light plate was deleted from commercial VA liquid crystal display (LCD5000), and the elliptically-polarized-light plate produced instead was stuck. When the contrast data of an omnidirection were measured about produced VA liquid crystal display, the angle of visibility from which a contrast ratio 20:1 is obtained was 160 degrees of four directions.

[0132] [Example 3]

(Production of an optical optically biaxial transparence base material) The cellulose triacetate 85 weight section, the triphenyl phosphate 10 weight section, and the ultraviolet ray absorbent (TM165, Sumitomo Chemical Co., Ltd. make) 5 weight section were dissolved in the methylene chloride, and the solution whose solid content concentration is 18 % of the weight was prepared. The solution was cast on the glass plate and it dried for 20 minutes at 40 degrees C. The formed film (thickness: 100 micrometers) was exfoliated from the glass plate. To the produced cellulose triacetate film, it is 2 20kg/mm for 10 minutes at 145 degrees C. Stress was applied. Thus, the retardation within a field (R_e) produced the optical optically biaxial transparence base material whose retardation (R_{th}) of 50nm and the thickness direction is 120nm.

[0133] (Production of an optical compensation sheet) It is coating liquid of an optical anisotropy layer used in the example 1 on an optical optically biaxial transparence base material 6 ml/m² It applied and dried at the room temperature. It heats for 1 minute at 130 degrees C, and orientation of the discotheque liquid crystallinity molecule was carried out, ultraviolet rays were irradiated, the polymerization of the discotheque liquid crystallinity molecule was carried out, and the orientation condition was fixed. The angular dependence of the retardation of an optical anisotropy layer was measured by the ellipsometer (Jasco Corp. make). Consequently, the average tilt angle of a discotheque liquid crystallinity molecule was 0.5 degrees. The retardation (R_{th}) of 50nm and the thickness direction of the retardation within a field of the produced whole optical compensation sheet (R_e) was 250nm.

[0134] (Production of a elliptically-polarized-light plate) To the transparence base material side of an optical compensation sheet, the laminating of the polarization film and the transparence protective coat was carried out to this order, and the elliptically-polarized-light plate was produced. The lagging axis of a transparence base material and the polarization shaft of the polarization film have been arranged so that it may become parallel.

[0135] (Production of a liquid crystal display) The elliptically-polarized-light plate was deleted from commercial VA liquid crystal display (LCD5000), and the elliptically-polarized-light plate produced instead was stuck. When the contrast data of an omnidirection were measured about produced VA liquid crystal display, the angle of visibility from which a contrast ratio 20:1 is obtained was 160 degrees of four directions.

[0136] [Example 4]

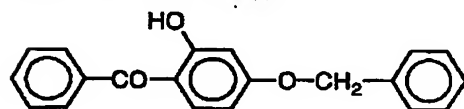
(Production of an optical optically biaxial transparence base material) 60.9% of cellulose acetate 45 weight section, the following retardation rise agent 2.35 weight section, the triphenyl phosphate 2.75 weight section, and the phosphoric-acid biphenyl diphenyl 2.20 weight section were dissolved in the methylene chloride 232.75 weight section, the methanol 42.57 weight section, and the n-butanol 8.50 weight section whenever [average acetylation]. The obtained

solution was cast using the drum flow casting machine, and the cellulose acetate film whose thickness after desiccation is 105 micrometers was produced.

[0137]

[Formula 35]

レターデーション上昇剤



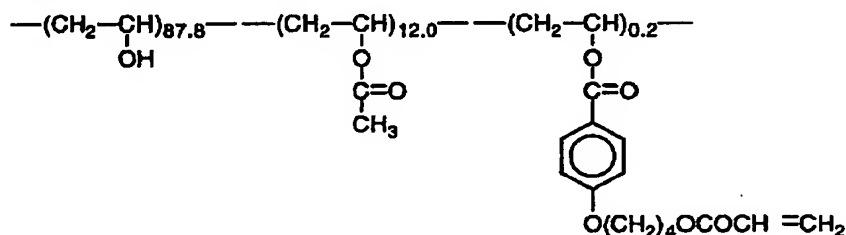
[0138] The cellulose acetate film was extended at 20% of real draw magnification, and the optical optically biaxial transparency base material was produced. The retardation of the transparency base material in the wavelength of 633nm was measured by the ellipsometer (M150, Jasco Corp. make). Consequently, 85nm and the retardation within a field (R_e) of the retardation (R_{th}) of the thickness direction were 40nm.

[0139] (Production of an optical compensation sheet) Gelatin was applied to one field of a transparency base material, and the under coat was formed in it. On the under coat, the 2 % of the weight of the following denaturation polyvinyl alcohol and the water solution of 0.1 % of the weight of glutaraldehydes were applied, it dried, and the orientation film with a thickness of 0.5 micrometers was formed.

[0140]

[Formula 36]

変性ポリビニルアルコール



[0141] The discotheque liquid crystallinity molecule (1) 90 weight section used in the example 1, the ethyleneoxide denaturation trimethylolpropane triacrylate (V#360, product made from Osaka Organic chemistry) 10 weight section, melamine formaldehyde / acrylic-acid copolymer (Aldrich reagent) 0.6 weight section, the photopolymerization initiator (IRGACURE 907, Ciba-Geigy Japan make) 3.0 weight section, and the photosensitizer (kaya KYUA DETX, Nippon Kayaku Co., Ltd. make) 1.0 weight section were dissolved in the methyl-ethyl-ketone 170 weight section, and coating liquid was prepared. Coating liquid was applied on the orientation film and it dried. It heated for 1 minute at 130 degrees C, and orientation of the discotheque liquid crystallinity molecule was carried out. Furthermore ultraviolet rays were irradiated, the polymerization of the discotheque liquid crystallinity molecule was carried out, and the orientation condition was fixed. The thickness of the formed optical anisotropy layer was 1.2 micrometers. The retardation of the whole optical compensation sheet in the wavelength of 633nm was measured by the ellipsometer (M150, Jasco Corp. make). Consequently, the retardation (R_{th}) of 40m and the thickness direction of the retardation within a field (R_e) was 160nm.

[0142] (Production of a elliptically-polarized-light plate) To the transparency base material side of an optical compensation sheet, the laminating of the polarization film and the transparency protective coat was carried out to this order, and the elliptically-polarized-light plate was produced. The lagging axis of a transparency base material and the polarization shaft of the polarization film have been arranged so that it may become parallel.

[0143] (Production of a liquid crystal display) The polarizing plate was deleted from the commercial MVA liquid crystal display (VL-1530S, FUJITSU, LTD. make), and the elliptically-polarized-light plate produced instead was stuck. The angle of visibility from which a contrast ratio 10:1 is obtained without image reversal about the produced MVA liquid crystal display was measured. A result is shown in the 1st table.

[0144] [Example 5]

(Production of an optical optically biaxial transparence base material) The norbornene resin (ARTON, product made from JSR) 30 weight section was dissolved in the methylene chloride 70 weight section. The obtained solution was cast using the band casting machine, and the norbornene film whose thickness after desiccation is 100 micrometers was produced. The norbornene film was extended at 15% of real draw magnification to the longitudinal direction, it extended at 7% of real draw magnification crosswise further, and the optical optically biaxial transparence base material was produced. The retardation of the transparence base material in the wavelength of 633nm was measured by the ellipsometer (M150, Jasco Corp. make). Consequently, 45nm and the retardation within a field (R_e) of the retardation (R_{th}) of the thickness direction were 40nm.

[0145] (Production of an optical compensation sheet) Corona discharge treatment of one field of a transparence base material was carried out. On the field which carried out corona discharge treatment, 2 % of the weight of denaturation polyvinyl alcohol used in the example 4 and the water solution of 0.1 % of the weight of glutaraldehydes were applied, it dried, and the orientation film with a thickness of 0.5 micrometers was formed. The discotheque liquid crystallinity molecule (1) 90 weight section used in the example 1, the ethyleneoxide denaturation trimethylolpropane triacrylate (V#360, product made from Osaka Organic chemistry) 10 weight section, melamine formaldehyde / acrylic-acid copolymer (Aldrich reagent) 0.6 weight section, the photopolymerization initiator (IRGACURE 907, Ciba-Geigy Japan make) 3.0 weight section, and the photosensitizer (kaya KYUA DETX, Nippon Kayaku Co., Ltd. make) 1.0 weight section were dissolved in the methyl-ethyl-ketone 170 weight section, and coating liquid was prepared. Coating liquid was applied on the orientation film and it dried. It heated for 1 minute at 130 degrees C, and orientation of the discotheque liquid crystallinity molecule was carried out. Furthermore ultraviolet rays were irradiated, the polymerization of the discotheque liquid crystallinity molecule was carried out, and the orientation condition was fixed. The thickness of the formed optical anisotropy layer was 1.4 micrometers. The retardation of the whole optical compensation sheet in the wavelength of 633nm was measured by the ellipsometer (M150, Jasco Corp. make). Consequently, the retardation (R_{th}) of 30m and the thickness direction of the retardation within a field (R_e) was 120nm.

[0146] (Production of a elliptically-polarized-light plate) To the transparence base material side of an optical compensation sheet, the laminating of the polarization film and the transparence protective coat was carried out to this order, and the elliptically-polarized-light plate was produced. The lagging axis of a transparence base material and the polarization shaft of the polarization film have been arranged so that it may become parallel.

[0147] (Production of a liquid crystal display) The polarizing plate was deleted from the commercial MVA liquid crystal display (VL-1530S, FUJITSU, LTD. make), and the elliptically-polarized-light plate produced instead was stuck. The angle of visibility from which a contrast ratio 10:1 is obtained without image reversal about the produced MVA liquid crystal display was measured. A result is shown in the 1st table.

[0148] [Example 6]

(Production of an optical optically biaxial transparence base material) The commercial polycarbonate film (Teijin, Ltd. make) was extended at 40% of real draw magnification to the longitudinal direction, it extended at 15% of real draw magnification crosswise further, and the optical optically biaxial transparence base material was produced. The retardation of the transparence base material in the wavelength of 633nm was measured by the ellipsometer (M150, Jasco Corp. make). Consequently, 100nm and the retardation within a field (R_e) of the retardation (R_{th}) of the thickness direction were 200nm.

[0149] (Production of an optical compensation sheet) Corona discharge treatment of one field of a transparence base material was carried out. On the field which carried out corona discharge treatment, 2 % of the weight of denaturation polyvinyl alcohol used in the example 4 and the water solution of 0.1 % of the weight of glutaraldehydes were applied, it dried, and the orientation film with a thickness of 0.5 micrometers was formed. The discotheque liquid crystallinity molecule (1) 90 weight section used in the example 1, the ethyleneoxide denaturation

trimethylolpropane triacrylate (V#360, product made from Osaka Organic chemistry) 10 weight section, melamine formaldehyde / acrylic-acid copolymer (Aldrich reagent) 0.6 weight section, the photopolymerization initiator (IRGACURE 907, Ciba-Geigy Japan make) 3.0 weight section, and the photosensitizer (kaya KYUA DETX, Nippon Kayaku Co., Ltd. make) 1.0 weight section were dissolved in the methyl-ethyl-ketone 170 weight section, and coating liquid was prepared. Coating liquid was applied on the orientation film and it dried. It heated for 1 minute at 130 degrees C, and orientation of the discotheque liquid crystallinity molecule was carried out. Furthermore ultraviolet rays were irradiated, the polymerization of the discotheque liquid crystallinity molecule was carried out, and the orientation condition was fixed. The thickness of the formed optical anisotropy layer was 3.5 micrometers. The retardation of the whole optical compensation sheet in the wavelength of 633nm was measured by the ellipsometer (M150, Jasco Corp. make). Consequently, the retardation (R_{th}) of 200nm and the thickness direction of the retardation within a field (R_e) was 300nm.

[0150] (Production of a elliptically-polarized-light plate) To the transprence base material side of an optical compensation sheet, the laminating of the polarization film and the transprence protective coat was carried out to this order, and the elliptically-polarized-light plate was produced. The lagging axis of a transprence base material and the polarization shaft of the polarization film have been arranged so that it may become parallel.

[0151] (Production of a liquid crystal display) The polarizing plate was deleted from the commercial MVA liquid crystal display (VL-1530S, FUJITSU, LTD. make), and the elliptically-polarized-light plate produced instead was stuck. The angle of visibility from which a contrast ratio 10:1 is obtained without image reversal about the produced MVA liquid crystal display was measured. A result is shown in the 1st table.

[0152] [The example 1 of a comparison]

(Production of an optical-isotropy transprence base material) The commercial cellulose triacetate film (Fuji Photo Film Co., Ltd. make) was used as a transprence base material. The retardation of the transprence base material in the wavelength of 633nm was measured by the ellipsometer (M150, Jasco Corp. make). Consequently, 40nm and the retardation within a field (R_e) were 3nm, and the retardation (R_{th}) of the thickness direction was the optical isotropy substantially.

[0153] (Production of an optical compensation sheet) Gelatin was applied to one field of a transprence base material, and the under coat was formed in it. On the under coat, 2 % of the weight of denaturation polyvinyl alcohol used in the example 4 and the water solution of 0.1 % of the weight of glutaraldehydes were applied, it dried, and the orientation film with a thickness of 0.5 micrometers was formed. The discotheque liquid crystallinity molecule (1) 90 weight section used in the example 1, the ethyleneoxide denaturation trimethylolpropane triacrylate (V#360, product made from Osaka Organic chemistry) 10 weight section, melamine formaldehyde / acrylic-acid copolymer (Aldrich reagent) 0.6 weight section, the photopolymerization initiator (IRGACURE 907, Ciba-Geigy Japan make) 3.0 weight section, and the photosensitizer (kaya KYUA DETX, Nippon Kayaku Co., Ltd. make) 1.0 weight section were dissolved in the methyl-ethyl-ketone 170 weight section, and coating liquid was prepared. Coating liquid was applied on the orientation film and it dried. It heated for 1 minute at 130 degrees C, and orientation of the discotheque liquid crystallinity molecule was carried out. Furthermore ultraviolet rays were irradiated, the polymerization of the discotheque liquid crystallinity molecule was carried out, and the orientation condition was fixed. The thickness of the formed optical anisotropy layer was 2.0 micrometers. The retardation of the whole optical compensation sheet in the wavelength of 633nm was measured by the ellipsometer (M150, Jasco Corp. make). Consequently, the retardation (R_{th}) of 3m and the thickness direction of the retardation within a field (R_e) was 240nm.

[0154] (Production of a elliptically-polarized-light plate) To the transprence base material side of an optical compensation sheet, the laminating of the polarization film and the transprence protective coat was carried out to this order, and the elliptically-polarized-light plate was produced. The lagging axis of a transprence base material and the polarization shaft of the polarization film have been arranged so that it may become parallel.

[0155] (Production of a liquid crystal display) The polarizing plate was deleted from the commercial MVA liquid crystal display (VL-1530S, FUJITSU, LTD. make), and the elliptically-polarized-light plate produced instead was stuck. The angle of visibility from which a contrast ratio 10:1 is obtained without image reversal about the produced MVA liquid crystal display was measured. A result is shown in the 1st table.

[0156] The angle of visibility from which a contrast ratio 10:1 is obtained without image reversal about the MVA liquid crystal display (VL-1530S, FUJITSU, LTD. make) of the [example 1 of reference] marketing was measured. A result is shown in the 1st table.

[0157]

[Table 1]

The 1st table ----- MVA liquid crystal The retardation of
 an optical compensation sheet An angle of visibility A display Re Rth Four directions Slanting
 four directions ----- An example 4 40nm 160nm 80
 degrees The 80-degree example 5 30nm 120nm 80-degree 75" example 6 200nm 300nm 80
 degrees Example 1 of 60-degree comparison 3nm 240nm 80 degrees Example 1 of 55-degree
 reference With no optical compensation sheet 80degree 45" -----

[Translation done.]

* NOTICES *

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the mimetic diagram showing the fundamental configuration of a transparency mold liquid crystal display.

[Drawing 2] It is the mimetic diagram showing the fundamental configuration of a reflective mold liquid crystal display.

[Description of Notations]

BR Back light

RP Reflecting plate

1, 1a, 1b, 1c Transparence protective coat

2, 2a, 2b Polarization film

3, 3a, 3b Transparence base material

4, 4a, 4b Optical anisotropy layer

5a Bottom substrate of a liquid crystal cell

5b The upper substrate of a liquid crystal cell

6 Cylindrical Liquid Crystallinity Molecule

[Translation done.]

* NOTICES *

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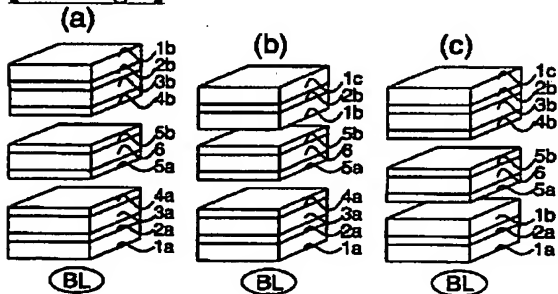
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.*** shows the word which can not be translated.

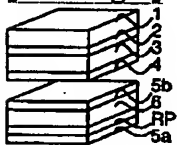
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]

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- 3.In the drawings, any words are not translated.

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law

[Section partition] The 2nd partition of the 6th section

[Publication date] November 10, Heisei 17 (2005. 11.10)

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[FI]

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G02F 1/13363

[Procedure revision]

[Filing Date] September 26, Heisei 17 (2005. 9.26)

[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] 0034

[Method of Amendment] Modification

[The contents of amendment]

[0034]

In order for the average tilt angle of the disk side of a discotheque liquid crystallinity molecule and a transparence base material side to carry out orientation of the discotheque liquid crystallinity molecule in the less than 5-degree condition, it is desirable to use a discotheque liquid crystallinity molecule and the compound which can carry out phase separation in the amount of the fixed range.

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] 0035

[Method of Amendment] Modification

[The contents of amendment]

[0035]

The compound which has a fluorine-containing surface active agent and a 1,3,5-triazine ring is contained in a discotheque liquid crystallinity molecule and the compound which can carry out phase separation.

[Translation done.]